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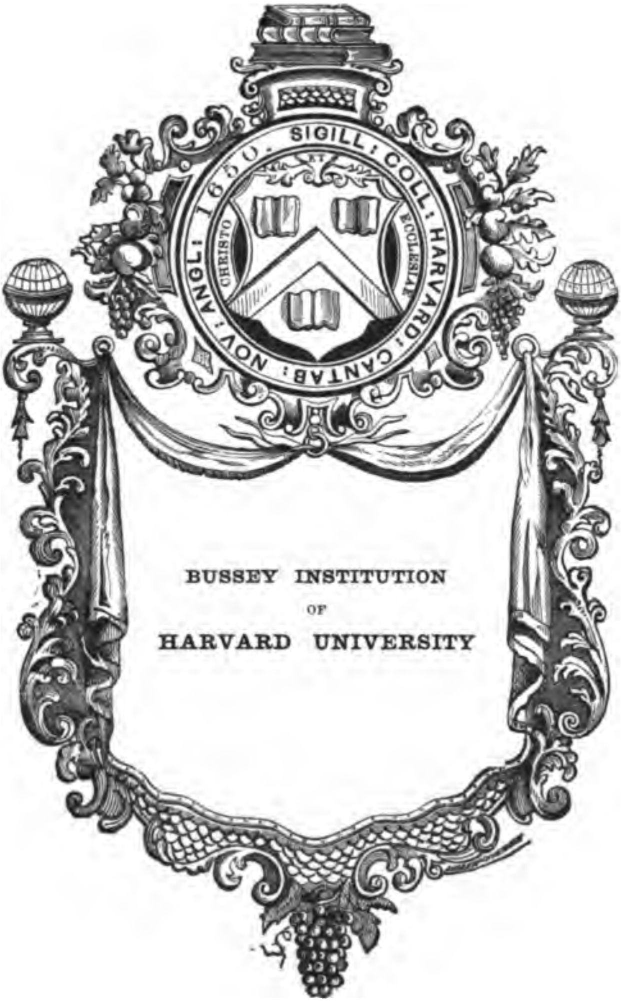

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EIGHTEENTH ANNUAL REPORT

OF THE

STATE BOARD OF AGRICULTURE

OF THE

STATE OF MISSOURI

FOR THE YEAR 1885.

JEFFERSON CITY, MO.:
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REPORT.

To the General Assembly of the State of Missouri:

The harvests are now, Nov. 10, completed, and the results well ascertained. The unfavorable fall growth of wheat in 1884 coupled with a winter of unusual severity, gave one of the most unfortunate wheat crops in the history of the State. The area sown had been diminished, by the force of low prices, by 10 per cent.; while the frost of winter further reduced this area, by ruined wheat necessarily plowed up, until the area harvested amounted to but 1,550,197 acres, yielding but 65 and a fraction per cent. of an average yield per acre, or 7.76 bushels per acre, giving a total yield of but 12,029,441 bushels. This yield is 13,734, 566 bushels less than the average yield of the State.

A new foreign competition has maintained a low level of price for this crop, and 80 cents will represent its full average sale value to farmers. Hence, we have as low a price as is usually received. The farmers of the State thus receive $10,987,652 less for their crop of wheat than the usual average. This loss has been severely felt on the farm, and has by an inevitable law extended its influence to all industries.

The conviction that wheat is to maintain a lower range of prices seems to have become deeply rooted, and is expressed in the lessened area sown to wheat for the fall of 1885, being 9.7 per cent. less than the area sown in 1884. With this decreased area of wheat has come an increased area laid down to the grasses and clover. A movement sustained by strong philosophical and practical reasons, and demanded, regardless of the price of wheat, as constant soil tillage without frequent interchange of crops and systematic alternations of grass as a protecting covering, is attended with the most unfortunate results to the individual and to the State. Soil impoverishment is the immediate and and general poverty the final result of such tillage.

In this harsh necessity is the germ of a higher type of farming. The more grass, the more stock and the more conservation of soil fertility, upon which fertility is based all the wealth of a high civilization.

The other large staple crops of the State, corn, oats, hay and pasturage, have been above the average yield of the State, as a table enclosed in this report will show. A review of those tables will show that the crops of the year, taken as a unity, are quite up to the average, and afford reasons for thankfulness There is some "poison" in this "cup of satisfaction." The tables show a heavy decline in the number of sheep kept. This is to be deeply regretted. Sheep raising may be made at once the most profitable and the most pleasurable branch of our live stock industry. The price of wool has been the apparent impelling cause of this rapid decline of sheep husbandry. It may be safely said that a deeper reason is the parent of the movement. The sheep is a creature of a more artificial farming, requring higher skill than pertains to our husbandry. Care, shelter, skillful feeding will, in a brief period, reestablish, on a more permanent basis, sheephusbandry, as the most profitable branch of our stock farming; and the mutton wool sheep will fill a place that the wool-sheep could not possibly fill by the side of ranch competition and under low wool tariffs towards which legislation tends.

The swine interests are likewise under the cloud of low value, 3 cents per lb., making a reduction of 25 per cent. Applied to our 4,000,000 swine that annually enter the markets we get another loss—hard to estimate—rising into millions, perhaps $5,000,000 or more. Cattle have declined one and one quarter cents per lb., aggregating for our stock going to market, $6,000,000 to $7,000,000 more.

To these animals and the horse, which, too, "is off" in value, is fed the great bulk of the staple crops above mentioned that are raised in the State.

From these we gain an indication of the lessened returns of our farmers. Aggregating these losses in revenue, including that of sheep and horses, with that of wheat, and excluding the consideration of minor crops ; we find that the revenue of our farmers is reduced by the vital sum of about $25,000,000, which considers only the annual sales and excludes the reduced value of stock on hand.

The influence of this factor on the liquidation of obligations, the extension of improvements, and the free purchase of the luxuries of life, is directly felt by all classes; and especially is it felt in its first influence on the farm. Truth compels me to say that our farmers are complaining of hard times and of ill paid labor, with some ground for their assertions.

Agriculture must expect its tides and meet its ebb and flow as well as other industries. In the widening competition in the great European markets for wheat and meat products, and for wool in our own, can be clearly seen cause to buckle on the armor for a keener contest.

We look out upon a new, higher and more aggressive type of farming to meet the clear demands upon us. There can be no question but that the capacity of our soil and of our people are adequate to meet these demands. Your own farm at the Agricultural College has framed its course, I may say, for a present and coming demand. And already clearly has demonstrated that higher farming based upon rotations, shelter of stock within its present means, manuring, more grass and clover, rigid economy of foods, thorough tillage, dairying and early maturity of its stock, pays—pays in present increased revenue and expanding fertility.

DISEASES OF THE YEAR.

The agriculture of the State has been prostrated by no sweeping epidemic. Several losses of moment have occurred from the native grasshopper, aided to some degree by the locust of the further west; the army worm has done some mischief; the chinch beg and the Hessian fly have aided. Hog cholera has contined its devastation in a large proportion of the counties, and often to a very serious degree. The disease known to farmers as black leg, or black-quarter, has been more than ordinarily prevalent. Glanders has been frequently reported to me; and the State Veterinarian, appointed to the office created by your honorable body during its last session, has been often in the field to visit cases, under legal call, and has shot many diseased animals. Embodied in this report will be found a bulletin upon glanders, issued from the State Agricultural College by the State Veterinarian, Dr. Paul Paquin, V. S.

CONTAGIOUS PLEURO PNEUMONIA.

During the past year a disease called contagious pleuro-pneumonia by Dr. M. R. Trumbower, V. S., United States Veterinary Inspector, and so endorsed by visiting veterinarians, broke out on the farm attached to the State Asylum for the Insane, at Fulton. The cattle attacked were purchased of Tripp Bros., of Illinois, the disease in whose herd could be traced by contact through several herds, to an eastern herd in a section where contagious pleuro pneumonia was known to exist. Through the herd originally introduced into Ohio, by sale to Illinois from the Ohio herd, and from the first herd of Illinois to several others of the same State, and thence to Kentucky, and finally to Missouri, the disease followed the moving herds. These facts gave strong presumptive evidence that the disease was contagious, and pleuro-pneumonia. After having been defined as such disease by Dr. Salmon, Chief of the Bureau of Animal Industry, by M. R. Trumbower, V. S., and by others, the excitement became intense throughout the infected area, and alarming to those of other States. It was felt that once beyond control the epidemic would be always beyond control, and would result in the virtual ruin of stock interests, because fatal to our export trade in live meat.

I will not follow the detailed history of the disease in Missouri, as accompanying documents have been added to keep on record this first affirmed outbreak of pleuro-pneumonia in Missouri.

In brief, the disease in question, by sales which mainly took place before its announcement, spread to several herds and involved a possible contact, it is said, with 1,200 to 1,500 animals, scattered over a large section of Callaway county. Animals were killed from several herds and found diseased, the herds not being confined to Fulton village.

Through the press the matter became noised abroad and invited the attention of several State governments, who sent their State Veterinarians, and these reported back contagious pleuro-pneumonia to their State authorities. In a short time Kansas, New Mexico, Nebraska, Wyoming, Iowa, Illinois, and other States and Territories, had quarantined against Missouri, paralyzing our trade in pure blooded stock, found in numerous herds all over the State. The quarantine of Illinois most seriously affected our fat stock trade, as this State is in the pathway of our fat stock commerce. The urgent calls by mail, the great number of calls in person, and a flood of telegrams from stock men for certificates of health for their stock, was beyond the authority of the law delegated to the Dean of the Agricultural College and to the State Veterinary Inspector to meet. For a time stock sales in the State were arrested at much private loss and public injury. By a special arrangement with Governor Oglesby, of Illinois, certain gentlemen were recommended as suitable to examine cattle and to issue certificates of health upon which cattle might freely pass through or into Illinois. It must be understood that this action had no force of law but was simply an agreement justified by pressing necessity and assented to by Governor Oglesby in the absence of law in Missouri ample to meet the exigency. The system gave great relief to stock men. This lack of good legal regulations or power delegated that would enable the quarantine of sections of the State, as well as the quarantine of single herds, as was enacted for the latter purpose, was made the basis of the sweeping quarantine of other States against the whole State of Missouri.

In an interview with Governor Oglesby, of Illinois, I was asked: "What guaranty can Missouri give that the disease will be confined to the few counties to which you ask me to restrict the quarantine of Illinois?" While our laws of the last session and those of a previous session touching Texas fever, come very near efficiency when combined, they do not meet the point of adequate local quarantine. With some amendments to our present laws we may in the future save the State the costly experience of unncessary restrictions imposed by sister States. The injury to our fat stock interests soon passed away, but not so readily the mischief to our heavy breeding interests, which are still suffering from the effects of the quarantine of other States, and the prejudices engendered. Herds of pure breeds fell fifty per cent. in value, and in counties near the seat of the disease the price of such stock is still affected materially, in fact castration of stock intended for western dealers has been necessitated.

The apparent obliteration of the disease was due to the active public spirit of the citizens of Callaway county, several gentlemen distinguishing themselves by their active efforts to stamp out the disease. Aid to their efforts was attempted to be given by the State officers and by the Board of Agriculture. Through these officers a small sum of money was raised to purchase diseased cattle. $500, I think, was raised at Kansas City by the efforts of the Governor and the State Auditor, while the Chicago & Alton Railroad donated $1,000 through the State Board of Agriculture, which sum was returned, not being needed. The citizens raised money to purchase about 150 head of cattle at two-thirds of their value and killed such cattle. This does not include about 70 head owned by the asylum, and killed.

The secretary was present in Fulton thrice, and at several conventions, to devise means to eradicate the disease, and was cognizant of the progress and decline of the disease and of the efforts to stamp it out, aiding so far as the law would allow him, and can testify to the good faith manifested towards the public by all concerned.

Unfortunately, Dr. Michener, V. S., United States Veterinary Inspector, who is from New York and from frequent observations of pleuro-pneumonia in its eastern home, and who was ordered here by Commissioner N. J. Coleman, of the Department of Agriculture, did not arrive until what was termed the typical cases had all been killed. Dr. Michener killed several animals but did not find the cases pleuro-pneumonia, and did not pass judgment upon the desease from personal observation. Doubtless we have been visited by as good a case of pleuro pneumonia as has been seen in the west, and have suffered in our commerce all the consequences of the presence of the disease.

Our duty as a State is clear, namely: To provide for the possible invasion of disease and for its control without the costly experience of this year.

Detailed information will be found in the bulletin on pleuro-pneumonia included in this report, and in the following articles.

From "The Breeders Gazette" I take the following report of Dr. Trumbower, made about the first of April, and while the disease was apparently spreading: "I received a telegram from Commissioner Loring February 25. This telegram requested me to go to Fulton and examine diseased cattle. After my arrival at Fulton I called at the Lunatic Asylum. Saw Dr. Smith, the Superintendent, and obtained from him a statement regarding the outbreak of the disease. He said the first animal noticed to be affected was about June 25th. Two died that day with black, watery diarrhœa. They had been sick four or five days. A few days later another animal was noticed to be ailing; it breathed heavy; had a cough; wouldn't lie down. A few days before it died its breathing became painful and laborious, and each respiration was accompanied by a painful moaning. It died about Feb. 3. Its chest was cut open and examined by Dr. Tichenor, one of the assistant physicians of the Asylum. He found one lung very much solidified, being in a state of what is commonly known as hepatization, and considerable fluid was in the chest cavities. The examination evidently proved that this was a case of some severe lung trouble, although the true nature of the disease was not known. A few days later two more cows were affected in the same way. After death they were also cut open. The lung of one was found in a state of gangrene and immensely swollen. Seven head died during the month of February, besides the two above mentioned, which died in January of diarrhœa. These two, I believe, were affected with the same disease, but septic poison setting in brought on the black diarrhœa.

March 2d I made my first examination, and discovered two cases of acute pleuro-pneumonia in the stable containing the milch cows, about forty-five in number. One of these cases registered a temperature of 105.8 deg., and emitted that painful moan or grunt at each breath which is peculiar to the acute type of this disease. Another case registered a temperature of 104½ deg. Breathing was quick and labored. She refused to eat her food that morning for the first time. On direct examination both of these cases presented extended consolidation of one lung, the effusions of serum into the chest cavity, and attachment of affected lung to rib. The one showing this extreme temperature was killed by me the 4th of March for examination. Upon opening the chest one whole lung was found engorged with blood, and an effusion of serum or lymph into the spaces dividing the globules of the lungs from each other. Three distinct stages of the disease were manifested in this lung. One portion of it, evidently having been affected for a month or six weeks, was characterized by the organization of fibre in the lymph spaces, and the hemorrhagic infraction being just at the point of death or necrosis, and being incapsulated. This animal showed all the positive characteristic conditions of true contagious pleuro-pneumonia or lung plague of cattle. The disease in this animal manifested all the violence found in European countries where the plague has been prevailing.

March 6th; I killed the other one, which had gradually become worse since the first examination, and also killed one at the same time which I considered to be an old chronic case. These two animals were killed in the presence of the Asylum Board of Physicians and in the presence of the Board of Managers of the Asylum, several physicians from the town, and a number of other persons who were invited to witness the examination. Many of these gentlemen were very skeptical about believing that this disease was contagious pleuro-pneumonia, but at the end of the examination all, without any exceptions, were thoroughly convinced that these cattle had been subjected to a malignant form of lung disease with which they were entirely unacquainted, and they had no reason to doubt any longer that this was the lung plague. The next examination was made before the investigating Committee sent by the Legislature the 10th of March. Two of the five members of the committee were physicians. I demonstrated to that committee the true nature of the disease to their own satisfaction, and they reported to the Legislature accordingly, with the request that some action should be immediately taken to stamp out this plague.

The next examination was made before the new Board of Managers of the Asylum. This board contains four physicians, from various portions of the State. I killed two animals in their presence for examination, and showed two typical or well-formed cases of this disease. This board were so well satisfied of the nature of the disease and appreciated the gravity of the situation to such an extent that they passed a resolution authorizing the Superintendent of the Asylum to kill the whole infected herd, with the proviso, however, that they desired first to consult the Attorney General of the State in order to learn whether or not they had the authority to order the killing.

By this time the citizens of Fulton and surrounding country became greatly alarmed and clamorous for the immediate extinction of the infected herd, for fear that this dread disease would soon spread to the surrounding country and into the neighboring herds.

About this time the report of the disease among the asylum herd having reached Kansas, the live stock commissioners of that State, who were then about to make up their quarantine list, requested Dr. A. A.

Holcomb, the Live-Stock Sanitary Commissioner, to go to Kansas City and make inquiries regarding the nature and extent of the disease. The stockmen ignored the reports from Fulton, and were loud in their statements that no pleuro-pneumonia existed at Fulton, but that it was simply a scare created by the Bureau of Animal Industry for a selfish purpose. They believed, if any disease existed among the cattle at Fulton, it was only tuberculosis or consumption. He urged upon them the necessity of making a direct examination of the matter, as it was necessary that they should know the exact nature of the disease without any guessing about it; that unless this was done the State of Kansas wou'd have to adopt measures to protect her own interests, and quarantine against Missouri. This alarmed the Kansas City stockmen, who declared that neither Kansas City nor the State of Missouri could afford to have such action taken against them. The following day Capt. J. H. Payne, A. B. Mathews, of Kansas City, and C. M. Lackland, of Mexico, Mo., accompanied by three veterinarians—Drs. Adair, Dundas, and Bates—left Kansas City for Fulton. Upon their arrival I killed one of the animals in their presence and made an examination of its lungs. The lung was so extensively diseased and so finely marked with the characteristic conditions of pleuro-pneumonia that all of these gentlemen, without exception, were compelled to acknowledge that true contagious pleuro-pneumonia existed in the herd at Fulton. They returned home and published the result of the examination in the daily papers of Kansas City, and requested that the people of the State of Missouri take immediate steps for the stamping out of the plague.

The next man that came to Fulton was Dr. E. T. Hagyard, of Lexington, Ky., who was sent for by Dr. Smith, Superintendent of the Asylum, at the request of the Board of Managers, to confirm my diagnosis. He arrived March 21st, and proceeded immediately to make an examination of the cattle on the farm. The following day I killed three head of cattle for examination, all three of which showed plain evidences of the disease. Dr. Hagyard was thoroughly convinced that they were afflicted with contagious pleuro pneumonia, and recommended the slaughter of the whole herd.

Dr. Holcomb, State Veterinary Surgeon of Kansas, arrived March 27th. He made examinations that satisfied him of the nature of the disease, confirming my previous diagnosis. At my request he remained to see what action would be taken at a meeting of the stockmen of the State, which took place March 31st.

The slaughter of the infected herd began March 27th. Previous to the beginning of the slaughter and before my arrival nine had died.

After my arrival I killed twelve for examination, all having shown plain evidences of the disease. The 27th we killed twenty seven head, all but three of which were diseased. The 28th we killed thirty-two head; of these twenty-three were likewise affected. The 31st the remaining five were killed in the presence of the visiting stockmen. Each of these were affected. This makes a total of eighty-five head that have died or were killed. Eighty-six per cent. of the whole number proved to be affected with pleuro pneumonia.

The stockmen took such action as will warrant the killing of all infected and exposed animals. As a result of this action I killed, April 1st, eighteen head of cattle belonging to A. T. Owens, of Fulton. His cattle had been in a field adjoining the Asylum herd, and showed evidence of the affection. I killed them in the presence of Gov. Marmaduke, the Hon. R. P. Bland, the Hon. N. D. Thurmond, Col. Robert McCulloch, Dr. R. E. Young, and several other persons from various portions of the State. After the slaughter I examined the lungs of six of these cattle for the purpose of showing to those visiting gentlemen the pathological conditions found in this disease. I firmly believe the disease can be stamped out before it extends beyond the boundaries of Callaway county. I most urgently request the people of Callaway county and of the State of Missouri, to maintain and to stand by this work until the last contaminated animal is buried, and the disease exterminated from this State without any question of doubt. I am sure that this can be done. It is absolutely necessary that it should be done to save the great cattle interests involved.

Tripp Bros., previous to their knowledge of the nature of the disease which affected their cattle, last season sold one bull to the State Lunatic Asylum at Fulton, Mo. He arrived at Fulton July 21, 1884, and was confined in a barn containing the milch cows for three days and a half. He was then turned into a meadow pasture among ten or twelve head of calves. Aug. 23d the steward of the Asylum received a letter from Tripp Bros., stating that pleuro pneumonia had broken out in their herd. They advised that the bull be isolated for three months, as they were fearful he might have contracted the disease. The advice was accepted, and the bull was taken one-half mile south of the main herd and turned into a thirty-acre field by himself, where he was allowed to remain for three and one half months, but unfortunately several head of cattle were grazing in an adjoining field, and there is a strong probability that they have been contaminated, although I have not yet had time to examine them.

Previous to his isolation this bull served two cows, both of which, when examined after death, showed old lesions in the lungs, indicating that they became infected soon after the arrival of the bull. The probability is that these two cows contaminated the balance of the herd. The bull also, after he was killed for examination, manifested positive evidence of having been infected at least eight months. The examination was made March 21st. Mr. Owens' cattle, killed the other day, broke into the field several times after this bull was brought back into the herd.

The definite determination of the existence of pleuro-pneumonia in Callaway county has attracted much attention in different parts of the State, and meetings have been held to devise means for protection against affected herds. It is not unlikely that Callaway county will be quarantined against by other counties, but the general impression seems to be that there is not only no good reason for other States to quarantine against Missouri, but that such action would be very detrimental to general interests and unwarranted by existing circumstances. Governor Marmaduke has been giving the subject particular attention for some time past, and sent the following dispatch to Governor Martin of Kansas:

JEFFERSON CITY, Mo., April 4.

Governor John A. Martin, Topeka, Kan.:

"Your State Veterinary Surgeon, Dr. Holcomb, has ere this doubtless advised you of his observations and views concerning pleuro-pneumonia now in this State. I, as Governor of this State, am giving the matter all attention in my power, and up to date my information is that it only exists in Callaway county, and the most efficient and prompt methods are being taken to stamp it out there and to follow it up and crush it out wherever it may be found. In the interest of the general public good, I trust you will not entertain the thought of quarantining against this State, for it only disturbs commerce, and I am sure it is not needed as a matter of protection. I'll keep you fully advised on this subject."

JOHN S. MARMADUKE.

Directly after this review of the situation by Dr. Trumbower, the States before named quarantined against Missouri. Reports got abroad and were believed in Fulton that 1,200 cattle had been exposed and that exposed cattle had been driven to several counties adjoining. This so alarmed cattle men that a meeting was called at Jefferson City; its main object being to induce Governor Marmaduke to call an extra session of the General Assembly. This, Governor Marmaduke declined to do on the ground that the General Assembly had adjourned while the disease was raging, and under the report of a committee of its own, declaring the existence of contagious pleuro-pneumonia at

Fulton, without doing anything regarding its eradication, and that there was no evidence that they had thus soon changed their views. After this, the farmers of Callaway county, abandoning hope of State aid, increased their previous efforts to raise money and killed in all 220 cattle. The result of this effort was to exterminate visible cases. The quarantine of other States still pressed very hard upon the cattle interest. This drew forth another cattlemen's convention to secure the withdrawal of the quarantine against us.

The following dispatch to the Globe Democrat sets forth the doings of this convention at Mexico, Mo.:

MEXICO, Mo., May 7.

The following protest and report were adopted here to-day:

To the Governors of Illinois, Iowa, Kansas, Colorado, New Mexico and Wyoming: The undersigned respectfully ask your attention to the accompanying report of proceedings of a meeting of representative men held at this place to-day. The parties participating in the meeting not only reside in and adjacent to the district recently infected with the disease of contagious pleuro-pneumonia, but have possessed unusual opportunity for observation of its progress and present status. We especially direct your attention to the report of Dr. Charles B. Michener, of the United States Bureau of Animal Industry, and beg to assure you that it presents both a truthful statement of the situation and a practical solution of the trouble. The quarantine restrictions, based upon reports of the prevalence of the disease in our midst, some of them grossly exaggerated, are proving a serious detriment to commerce, both in our State and yours, and are resulting in a daily loss of many thousands of dollars. The disease is now confined to a limited district, in which to-day not a single acute case can be detected after close inspection. Why should quarantine regulations be enforced against all the remainder of the State? Why not concentrate restrictions to this limited district and liberate the State? We hope your Excellencies will perceive that a necessity for general quarantine does not exist, and that you will see fit to take such prompt action as to permit trade to resume its legitimate channels.

Very respectfully,

CHARLES H. HARDIN,
S. S. LAWS,
T. R. H. SMITH,
J. W. SANBORN,
C. A. BAILEY,
Committee.

THE MEETING.

Following is the report of the meeting referred to:

At a meeting of prominent citizens of Boone, Callaway and Audrain counties, held in Mexico, Mo., May 7, 1885, the following, among others, were present: Governor John S. Marmaduke, Dr. Chas. B. Michener, representing the Bureau of Animal Industry; Dr. S S. Laws, president of the Missouri State University; Prof. J. W. Sanborn, Dean of the Missouri Agricultural College, and E. W. Stephens, of Columbia; Dr. T. R. H. Smith, superintendent of the State Lunatic Asylum at Fulton; J. L. Erwin, Judge O. A. Bailey, Sisera Threlkeld and Jas. Rickenbaugh, of Callaway; ex-Governor Charles H. Hardin, Col. R. E. Lawder, James Callaway and others of Audrain.

Governor C. H. Hardin was called to the chair and E. W. Stephens chosen secretary.

Dr. Laws stated the object of the meeting to be to confer with reference to the best method of relieving Missouri of the quarantine restrictions that had been placed upon her on account of the prevalence of pleuro pneumonia in Callaway county, and to set forth the views of those present, all of whom were well acquainted with the facts of the present extent of the contagion, and to suggest means for its complete eradication.

DR. MICHENER'S REPORT.

Dr. Michener then read the following report:

Prof. J. W. Sanborn, *Dean of Agricultural College*, *Columbia*, *Mo.*:

Dear Sir: I deem it my duty, as it is also my pleasure, to present to you the following statement, and I make the statement to you for the reason that you are at the head of the Agricultural Department of this State, which appoints and controls its veterinary service. The subject matter of my communication is contagious pleuro-pneumonia in this State, the extent of it at present, its obstructions to commerce and its final extermination. In my official capacity I have been investigating this outbreak and assisting in extarminating the disease from this State. The history of this outbreak is too well known to you to need repetition. You also know the number of cattle that have been affected, the number destroyed and the number of probably exposed or infected herds. I beg to state that the work of the past two weeks has proven conclusively to me that the disease is not so widespread as it was at first thought; that the probabilities of any further developments are reduced to a minimum; that there is not, even now, a single case of acute, contagious pleuro pneumonia in Callaway county, and that at no time has there been a single instance of the disease outside of this county, nor more than twelve miles from Fulton, the county seat. That the disease has been so early encompassed and so effectually checked is due entirely to the prompt and decisive measures adopted and carried out under the special direction of Dr. M. R. Trumbower, Veterinary Inspector of the Bureau of Animal Industry, viz: the killing of all cattle actually diseased, and those that were in the herds so affected, and to the existence of a rigid voluntary quarantine of those cattle that were in pastures adjoining actually diseased herds.

From the facts, as above stated, it is apparent to me that the proper course to pursue is to raise a small amount of money by voluntary contributions, probably not more than $10,000; that this amount be placed in the hands of the State Treasurer, and to be used as occasion requires during the next six months in keeping up a vigorous watching and pursuit of all cattle within the infected district, and further, to be applied to killing at once all cattle in herds where outbreaks may occur.

In so far as inter state quarantines are concerned, I wholly fail to see why such restrictive measures should not be rescinded, except in reference to the county of Callaway. From all counties of the State, in order to prevent all possibility of infecting other States, owners or shippers should be requested to make affidavit, at point of shipment, that such consignment of cattle has not come from Callaway county, nor been exposed to contagious pleuro-pneumonia at any time or place. No cattle should be allowed to pass from the county of Callaway, except upon the certificate of an official veterinarian, and this only to be given after a most careful personal inspection.

I trust that the present favorable condition of affairs here will not permit you to assume that our duty is done. There is a plain, imperative necessity for a close watch and intelligent, prompt and energetic action during the next six months. By this course I feel confident that we will not only rid the State of pleuro-pneumonia, but we will also be able to restore our commerce without in the least particular endangering the cattle interests of other States.

(Signed) C. B. MICHENER, D. V. S.

RESOLUTIONS.

After a free discussion, the report was unanimously adopted as the sense of the meeting, with the amendment that when a party could not take the oath suggested, the cattle belonging to such party be subject to inspection by a veterinarian authorized to make such inspection.

Dr. Laws offered the following resolution, which was adopted:

Resolved, That the attention of the public be specially called to sections 4358 to 4369 of the Revised Statutes of 1879, and that we recommend the active enforcement of said sections, which law is deemed ample to meet the exigencies which exist or may arise.

The following resolutions were also adopted:

Resolved, That the Board of Agriculture be requested to make prompt and energetic efforts to raise the sum of $10,000, to be deposited with the Treasurer of the State, and to be paid out on vouchers audited by the Governor, Auditor and Attorney-General, setting forth the facts of each case in which an expenditure shall be made in aid of stamping out pluero-pneumonia from the State of Missouri.

Mr. E. W. Stephens offered the following resolution, which was unanimously adopted:

Resolved, That the Executive Committee, consisting of Governor C. H. Hardin, Dr. T. R. H. Smith, Dr. S. S. Laws, Judge C. A. Bailey and Prof. J. W. Sanborn, be hereby appointed to transmit the proceedings of this meeting, together with the report of Dr. Michener, to the Governors of the various States which have quarantined against Missouri, and to the newspapers of these States for publication, and that they accompany the same with a suitable address setting forth the true state of facts touching the condition of pleuro-pneumonia in this State, and appealing to the Governors of the States aforesaid to remove the quarantine restrictions from this State, except in reference to Callaway county, inasmuch as the necessity for such restriction does not exist.

The thanks of the meeting were unanimously tendered Governor Marmaduke for the active interest he has manifested in endeavoring heretofore to secure the extirpation of the disease and also for his presence on this occasion.

The Dean of the Agricultural College was requested to superintend the distribution of the blank affidavits to shippers, as suggested in the report of Dr. Michener, and also to the execution of all such other details contained in said report as may become necessary.

Dr. Laws offered the following resolution, which was adopted:

Resolved, That it is the sense of this meeting that, in view of what we know to be the assured facts, there is no necessity for the appointment of veterinary inspectors in any part of the State outside of Callaway county.

Maj. Lawder offered the following amendment to the resolution of Mr. Stephens, which the latter accepted and which was adopted:

Resolved, That a committee appointed by the meeting, take such action as they may deem necessary to convey to the United States Department of Agriculture a correct statement of the condition of the disease in this State, and ask the co-operation of that department in obtaining the removal of quarantine restrictions at the earliest practicable moment.

The meeting was a quiet, harmonious one, and was marked by a free discussion of the whole subject, the unanimous sentiment of those present being that the report submitted by Dr. Michener and adopted contained a practical and safe solution of the whole trouble, and that there exists no necessity for a continuance of the quarantine restrictions, which are operating so greatly to the detriment of commerce in this and adjoining States.

At the close of this convention the Secretary, by request, visited Governor Oglesby and set forth, in detail, the situation in Callaway county. After some time of deliberation the quarantine of Illinois was withdrawn, and subsequently the quarantine by other State was withdrawn.

The disease has not manifested itself since the above date of this convention.

In accordance, however, with the vote of the convention, the secretary issued a call for money and gave it a wide circulation with the result before mentioned. I add in this connection the report of the State Veterinarian:

BULLETIN NO. 15.

Prof. J. W. Sanborn, *Dean of the State Agricultural College, Missouri State University, Columbia, Missouri:*

Dear Sir: In accordance with your desire, and within the meaning of the law under which I have had the honor of being appointed to the responsible position of veterinarian for the State of Missouri, I respectfully submit this, my first official bulletin. The reported outbreak of pleuro-pneumonia at Fulton, is the only matter of special interest that has as yet come to my notice.

CONTAGIOUS PLEURO-PNEUMONIA.

DEFINITION.

A disease of specific nature; of a highly infectious character and which is special to cattle. It is most insidious—no signs of illness being detected as a rule for a period of from two weeks to two months, and sometimes even four months or more, and during which time the lungs are slowly undergoing changes due to a progressive inflammation which manifests itself mainly by a slow fever.

HISTORY.

Like other contagious and infectious diseases, it is impossible to trace back the history of this dreadful plague to its very origin.

Aristotle, who wrote 350 years before Christ, spoke of a lung disease among cattle that was perhaps the same; the Romans and the Greeks described lung maladies much alike, but not before the time of the celebrated Bourgelat, the founder of the veterinary school, did we have any tolerable description of it, and the immortal Haller (more than a century ago) was the first man who pronounced it contagious. It is reported to have appeared since in a great many countries of the world, but we will briefly review only some of the principal outbreaks.

The disease was introduced into Holland by a Prussian cow, in 1835; into Ireland by a Dutch cow, in 1839; into England by Irish and Dutch cattle, in 1842; into Sweden and Denmark by English cattle in 1847; into Norway by infected Ayrshires, in 1860; into Oldenburg also by Ayrshires, in 1858; into Schleswig again by Ayrshires, in 1859; into Cape of Good Hope, in 1854; into Australia, in 1858, by an English cow. In this country it appeared for the first time at Brooklyn, L. I., in the year 1843, and was brought there by a Dutch cow; and in 1850 it was introduced there again by an English cow. In 1847, it invaded New Jersey by English stock, and in 1859 it infected Massachusetts by Dutch cattle.

In Denmark, Sweden, Norway, Oldenburg, Schleswig, Massachusetts and New Jersey it was after a time stamped out. In the latter place it was extirpated by the heroic action of one man—Mr. Richardson, an importer—who sacrificed his entire herd, valued at $10,000, and voluntarily assumed the loss. By that admirable conduct, New Jersey undoubtedly saved many thousand dollars. However, the disease reappeared in that State again from other sources. In 1865 it existed in Maryland; in 1868 it was in Pennsylvania; between 1881 and 1883, in Connecticut. In a word, the plague has existed in this country over forty years, notwithstanding all the efforts to extirpate it. New York, Pennsylvania, Maryland, Massachusetts, Delaware, District of Columbia, Kentucky and Ohio, all were visited, and not long ago it appeared in Illinois, whence we are told it reached Missouri by a bull bought in July last, 1884, by the State Lunatic Asylum, from Messrs. Tripp Bros.

SYMPTOMS.

At the very beginning of this malady it is impossible to detect any special symptoms even by a close observation or by examination of the lungs by listening to them through the walls of the chest. The poison or specific virus enters into the system by the respiratory organs and then slowly infects the lungs without showing signs of its disastrous work until it has struck, as we may say, the fatal blow.

Like other organic diseases, the first symptoms to be noticed are the ordinary signs of ill health, viz.: staring condition of the coat, unthriftiness, separation from the herd, etc.; later, a short peculiar painful cough may be heard occasionally, especially in the morning, after drinking, or when being hustled. The temperature may rise to 103 degrees, and as the disorder progresses, may reach 104, 105, or more. A slight crepitation or mucous murmur may be detected in one or both lungs. Later on, the animal stands with elbows distant from the chest; the cough is more frequent and painful; the milk diminishes; the skin becomes yellowish and dirty; the back is arched; the muzzle is protruded; the nostrils are dilated; the respiration is faster and the expiration is accompanied by a peculiar characteristic grunt. By listening to the lungs we can determine dullness in certain portions of one or both, and sometimes in the largest portion of them. This is due either to the fluid in the chest or to the consolidation of the lung tissues. If one lung only is badly affected, we may hear a louder murmur in the other. Sometimes we hear a "friction sound" which indicates that the pleura or membranes surrounding the lungs are also affected. Occasionally the breath becomes foetid and a watery discharge, which gradually becomes purulent, takes place from the nostrils. Finally debility,—pallor of mucous membranes, diarrhœa, swellings retaining the impression of the fingers (œdematous)—appear, and death soon follows. However, the disease may sometimes run its course more rapidly, and death may occur from the effects of congestion.

DIFFERENTIAL CHARACTERS.

Many reputable physicians do not concede that the disease is an extraordinary one. They base their opinion on the ordinary cases of pneumonia or pleuro-pneumonia which they often treat in man, and which may attack all kinds of domestic animals. There is, however, a vast difference between them. In those ordinary sporadic cases, the symptoms appear more suddenly; generally both lungs are diseased and the lesions are uniform. "The stage of the disease is also uniform and we do not notice the sudden transition as in the infectious disease," (Steele,) and besides, we can never trace its origin to contagion, while in contagious pleuro-pneumonia, the lungs are diseased in circumscribed portions next to which the tissues may be perfectly healthy one lung only may be affected, and the affection is an insidious, progressive one. Its first stage may last weeks and months and it may always be traced to contagion.

TREATMENT.

The death rate in this plague varies much; it ranges from 20 to 70 per cent., according to the type of the outbreak, and no treatment has yet been found to diminish this percentage. Animals that recover are apt to propagate the disease during the period of their convalescence which may last over two months. Therefore we see that it is wiser to sacrifice the animals at once. Inoculation has been tried as a preventative treatment, and in some places it was successful, but one of the great disadvantages of it is that an animal which is inoculated may also propagate the disease, and hence, no animal should be thus treated without being quarantined for about three months—a treatment which would be too expensive. Besides that, many accidents follow that practice: for instance, gangrene of the parts inoculated. The operation is generally practiced at the tip of the tail, and as a result it is not uncommon to see the tail rot and fall off.

OUTBREAK AT FULTON, MO.

I can say very little in regard to this outbreak from personal observations: I went to Fulton after the Asylum herd and the Owens cattle had been killed, and it is among those animals that Dr. Trumbower found his typical cases. From the former herd he pronounced his diagnosis, and from the latter his opinion was still more confirmed. I examined many herds after that and found some to be suffering from lung troubles, but it was every time at such an early period that I had to draw my conclusions from the history given to me by the proprietors and Dr. Trumbower. Therefore, it is on the pronounced opinion of this official that I base this part of my report which treats directly of the disease in Callaway county. The facts are in substance as follows: A few days after Messss. Tripp, of Peora, Ill., had shipped the bull alluded to before, to the State Lunatic Asylum at Fulton, they discovered that pleuro-pneumonia existed in the herd whence he came, and immediately informed the purchasers of this fact, recommending at the same time a complete isolation. This was done for nearly three months, and during that period he showed no signs of illness, and he was consequently allowed to go with the other cattle anew. Afterwards a cow became sick, and about the 8th day of November (1884) she died, and then eight or nine others became sick and died, one after another. The managers of the Asylum becoming alarmed, informed the Department of Agriculture at Washington of the circumstances, and Dr. Trumbower, whom I have mentioned above, and who is an educated and able veterinarian in the employ of the Bureau of Animal Industry, was sent to make an investigation. He arrived on the 1st day of March, (1885,) immediately examined the herd, and found a number of cattle suffering from lung troubles, and in tracing the history of the Tripp bull, he suspected pleuro-pneumonia. About a dozen head were slaughtered to make post-mortem examinations, and from these, as I have stated, Dr. Trumbower announced that it was contagious pleuro-pneumonia. A number of veterinary experts of note visited the diseased animals at that time and confirmed that opinion. Among these gentlemen I will mention Dr. Hagyard, of Kentucky, who has had considerable experience in Europe, and who made the examination of the bull mentioned.

A meeting of a number of citizens of Callaway county was held afterwards and a committee appointed to appraise and kill the cattle that Dr. Trumbower would pronounce diseased, or that had been sufficiently exposed to become infected. The committee consisted of Messrs. C A. Baily, John L. Erwin and Sisera Threlkeld. About $2,500 were subscribed and the gentlemen immediately began to investigate, appraise and kill, and they have now been working faithfully and methodically for weeks without any remuneration even for their time. Some 150 head, exclusive of the Asylum herd, and which had been directly or indirectly exposed to the latter, were slaughtered and buried. Dr. Michener, Professor at the American Veterinary College, and Inspector of the Bureau of Animal Industry, and who has been here nearly two weeks, says that the work has been so skillfully done that he thinks that the majority of the cases that were supposed to have the disease or capable of spreading the malady, have been slaughtered. The situation at present is certainly reassuring. We have this day visited six herds near Fulton and have found among the seventy odd head examined, but two suspicious cases, and there is nothing positive about them. It seems to me that the patient and effective researches of Drs. Trumbower, Michener and the committee, with that pitiful sum of money at their disposal, are going to be crowned with success. However, we must not think that there is no more danger. I do not say that the disease is stamped out. The vigilance of the people must continue, though the disease may appear to be extirpated, we should bear in mmind that it may break out again later, as it is reported to have done in Illinois a few weeks since, after having been dormant for about seven months. One single animal left with contagious pleuro-pneumonia might be the cause of spreading it throughout the State. According to experts, the type of the disease here is mild, and in fact we can readily judge that from the actual situation.

No matter what may be the results of this outbreak, the people of the State owe to the appraising committee a debt that they ought never to forget.

ITS DISASTROUS EFFECTS.

We will give a few facts and figures to show the terrible losses caused by pleuro-pneumonia. In Massachusetts it took from the year 1860 to 1866 to exterminate the plague. A committee legally appointed worked hard all that time and spent $67,511.07, appropriated by the State, and $10,000 raised by private subscriptions, or a total of $77,511.07.

Australia lost $44,000,000 all by one cow that was supposed to have recovered, but which nevertheless spread the disease.

In the North of France it killed in nineteen years 212,800 cattle worth 52,000,000 francs (or $10,400,000).

Between 1842 and 1869, England lost, it is estimated, 5,548,780 head of cattle worth $400,000,000. During the following nine years, she lost about $1,000,000 more. Now, besides the deaths, if we count the "contingent expenses of deterioration of health, loss of markets, progeny, manure, etc.," (Live Stock Journal, 1878,) and the disturbed condition of trade through quarantines and disinfection, we may estimate that the actual losses caused directly by the disease amounts to enormous sums every year.

PAUL PAQUIN, V. S.

Missouri State Veterinarian, State Agricultural College, Missouri State University.

COLUMBIA, April 29th, 1885.

WORK OF THE BOARD FOR THE YEAR 1885.

By the generosity of the last General Assembly, the Board's income was raised from $1,250 to $2,500, a sum but a fraction of that devoted to the work in other States, yet sufficient for an increase of former work, and to accomplish much good.

The list of crop reporters was at once enlarged to 1,050, and the monthly crop reports widened in scope and thoroughness.

An enlargement of the number of Institute meetings has followed, and specialists from abroad secured, by payment of traveling expenses, to aid in giving them higher value, while special work has been entered upon that involves expense, such as illustration of our grasses of Missouri for this report, etc.

The correspondence of the office has now become very large and beyond the power of one man to keep well up with, when coupled with the monthly crop reports. Where we had no calls for meetings three years ago, we now have on file about 25 invitations to meet with the people and present the higher agriculture.

The secretary has made a persistent attempt to procure statistical data of the growth of the State in its agriculture, population, wealth, manufactures, and in material growth generally. Such facts I find it impossible to secure with certainty of their reliability. Much labor has been devoted to this work that has been fruitless. But one way seems to be open to secure the data that our citizens persist in requiring of this office, and that way is through the enlargement of the duties of our assessors, who can cheapy secure invaluable facts in conjunction with their usual work, as is done in Illinois, Kansas and other States. I prepared such a scheme, which was presented to a committee of your honorable body, receiving a full support from them, I believe, and a heavy vote in its favor in the House, but less than a majority. If this work is to be done it can only be done by your aid.

I have embodied in this report such facts as I can procure from county clerks, state officers, city officers and regular correspondents.

Believing that the growth of our cities has a most important relation to the character and prosperity of our agriculture, I sought to obtain from our most important large towns statistics of the growth in all of their elements of wealth, but have failed to receive the response that I expected. State laws can alone do the work that is done in this direction in other States by State laws.

The secretary regrets to find a disposition quite general to hold this office responsible for deficient State laws in this regard, expecting from it full statistical data.

Respectfully submitted,
J. W. SANBORN, Secretary.

ANNUAL MEETING OF THE BOARD OF AGRICULTURE FOR 1884.

Agricultural College Building,
Columbia, Nov. 5, 1884.

In accordance with the law, the Board of Agriculture convened in the Agricultural College building at 10 A. M, Nov. 5th. No quorum being present, an adjournment was taken to 10 A. M., Nov. 6th.

Nov. 6th, 10 A. M., the Board met according to adjournment.

President Walker in the chair.

A call of the roll gave a quorum present.

Members present:

Hon. John Walker, President,
Hon. H. Eshbaugh, Vice-President,
S. S. Laws, LL. D.,
M. F. Doud, Esq.,
Hon. John Rippey,
J. A. Potts, Esq.,
J. W. Sanborn, Secretary.

The President made a few appropriate opening remarks in review of the bounteous crops of the season. He then spoke of the wealth of the State as "a round billion of dollars, with three millions likely to be in the State Treasury before the General Assembly meets." "The State will then be in condition to meet the wants of this Board so pressingly needed."

The appointment of a committee on legislation was advised. "We need to change the tenure of our office from life tenure to one of short duration, say two going out yearly. We want to organize a library, and prosecute machinery trials, the plow trial made by our Board being sought after through our report by foreigners. The Agricultural College deserves our aid and encouragement."

Dr. Laws remarked, that "instead of the Agricultural College being incident to the University, as many esteemed it, it is really the principal interest in the amount of its funds and in the class it represents."

After a general discussion of the needs of the Board and the work it should perform, it was voted on motion that the Board proceed to the election of officers at 3 P. M.

In response to a call, the Secretary read the proceedings of the last annual meeting. The report was amended, the statement that "the officers held over bv law no successors being appointed," was added.

On motion of Mr. Doud, the report, as amended, was accepted and adopted.

On motion of Mr. Doud, a committee of two was appointed to examine and report upon the treasurer's account at the evening session.

The chair named Messrs. Doud and Potts to constitute that committee.

On motion of Mr. Doud, it was voted that those who attended the General Assembly, to present the claims of the Board for an appropriation, be requested to present bill to Board for payment of expenses for services rendered; also, that Secretary Sanborn present his bill for cost of trip to Kansas City Fat Stock Show, on Board business.

Moved by Mr. Eshbaugh, that Judge Walker and Mr. Sanborn be appointed a committee on legislation. Voted.

Moved by Mr. Rippey, and seconded, that we now adjourn to two P. M. Voted.

TWO P. M.

Met according to adjournment.

Moved by Mr. Doud that we now proceed to the election of officers. Carried.

In voting for President the ballot stood six for John Walker and one for Mr. Eshbaugh. Mr. Walker was declared elected, but he declined the nomination. The valuable services of the President of the Board and his fitness for the office were reviewed by Mr. Doud and also by Mr. Eshbaugh.

Both of these and other members of the board urged Mr. Walker to withdraw his declination. To the urgent appeal made, Mr. Walker finally consented to listen and accepted the position.

Ballot was next taken, on motion of Mr. Potts, for Vice-President. Vote: Six for Mr. Eshbaugh, and one for J. A. Potts. The chair declared Mr. Eshbaugh elected.

Ballot was next taken for Secretary. The vote stood six for J. W. Sanborn, and one for H. Eshbaugh.

J. W. Sanborn was declared elected for the following official year.

The Treasurer was next balloted for, with the result of six for S. M. Tracy, and S. M. Tracy was declared elected.

The report of the Committee on Legislation was next called for, which was read by J. W. Sanborn, for committee, and was as follows:

Your committee, to whom was referred questions requiring legislative action, beg to report the following, namely:

We recommend that a committee of two be appointed to present for adoption, to the coming General Assembly, at the expense of the Board, the following additions to and changes of the present laws affecting agriculture and the Board of Agriculture, to wit: It is recommended that we ask $2,500 for general expenses, $500 for machinery trials, and $500 for founding a library; that we ask for the enactment of laws requiring county assessors to collect and forward to the Secretary of the Board the acreage and the amount per acre of the various farm crops; also, laws requiring said assessors to return the number, age and death rate of each class of live stock; that we ask for funds for the establishment of a State veterinary chair at the Agricultural College, to be filled by a good practitioner whose services are to be at the call of the State; we also ask for the passage of laws enabling the Board of Agriculture to control diseases originating within the State, and to restrain the importation of diseases originating from beyond our borders; that we ask for a change of the life tenure of office, under which members of the Board now serve, and in lieu thereof ask for laws requiring the retirement of two members annually, selecting those whose term of service is longest; that we ask the increase of the Secretary's salary from $600 to —— annually, from which sum the Secretary shall be required to employ a competent assistant and prosecute more fully the crop reports inaugurated for the season of 1884; that we ask the State to print and distribute our reports on the same conditions that other State documents are printed and distributed; that we ask the State to perfect the organization of the State College Farm by an appropriation that will at once equip the farm for teaching, for valuable experimental work and to reflect credit on the State and on the State College; that we request the Secretary to enter into correspondence with the Secretary of the Kansas City Fat Stock Show for the purpose of forwarding the stock interests of the State, on a basis for the mutual benefit of both; that we ask for a change of the date of our annual meeting from the first Wednesday of November to the last Tuesday of October; and the committee are to take into consideration such other laws and changes as in the minds of the committee the circumstances require.

At the close of the reading of the report, Mr. Doud presented a scheme for organizing the crop reports and other work of the Board somewhat similar to the Kansas Board system.

He desired 10,000 monthly crop reports, reports for six months, two quarterlies and one biennial report.

After much discussion, on motion of H. Eshbaugh, Mr. Doud was requested to pass his papers to the Secretary, and his motion and documents were referred to the Committee on Legislation.

H. Eshbaugh moved that the blank sum for Secretary's salary in the Legislative Committee's report be filled by the sum of $2,000. Carrie

Moved by Dr. Laws that the sum of $3,500 annually, be substituted for the sum of $2,500 in the committee's report for general expenses of the board. Carried.

Mr. Potts moved that the Legislative Committee's report be adopted. Carried.

Moved by Mr. Eshbaugh that the President and Secretary be made the Legislative Committee, with authority to call in aid of others at the expense of the Board. Carried.

Moved by H. Eshbaugh, that the President and Secretary be empowered to call a meeting of the Board of Agriculture for a Farmer's Institute Meeting, and to invite Dr. N. Cressey to address it.

Mr. Doud moved that a committee be appointed to draft resolutions, expressive of the board's sense of the deep loss it met in the death of its former Secretary, R. W. Gentry, and of the high esteem in which it holds his memory. Carried.

Hon. John Walker, by general request, was made this committee.

This committee submitted the following report:

WHEREAS, It has pleased Almighty God to remove from the active scenes of this life, in the fullness of his young manhood, R. W. Gentry, a member and Secretary of the Board of Agriculture of the State of Missouri; and it becomes the duty of this board to take official notice thereof, and to give fitting expression to the sorrow resting on them as members of the State Board of Agriculture, as well as to bear testimony to the manly virtues and social worth of the deceased; therefore be it

Resolved, That in the death of R. W. Gentry, this Board mourns the loss of one of its most faithful and efficient members; one who thoroughly comprehended the importance of the work assigned to him, and who devoted himself with rare energy and singleness of purpose to the vast interests of which he was a representative.

Resolved, That the cause of agriculture had an active, earnest and intelligent friend in R. W. Gentry, and that the loss to this interest occasioned by this death is greatly to be deplored.

Resolved, That in the death of our associate the State loses one of its most faithful, conscientious and intelligent officers, while an old and honored family bemoan a beloved and cherished member, possessing all the virtues of a noble manhood.

Resolved, That in their great bereavement we tender to his stricken family our heartfelt sympathy and condolence.

Resolved, That in respect to the memory of our friend, these resolutions be spread upon the record of this Board; that a copy of the same be furnished his family, and that as a token of high regard for his memory, mingled with profound sorrow at his untimely death, this board do now adjourn until 7 o'clock P. M."

7 O'CLOCK P. M.

Met according to adjournment.

President Walker in the chair.

Mr. Doud read laws regarding vacancies, and moved that section 10 of by-laws be enforced against members who came under its provisions.

Mr. Eshbaugh moved an amendment as follows, namely: That we ask for the resignation or active co-operation of those who have failed to attend for two annual meetings of the board, and that the names of each be acted upon separately.

This subject was much discussed, and the strong hope expressed that each member affected would actively aid the board.

The Secretary was informally instructed to notify each member to this effect.

On vote being taken on the name of K. M. Lear, his resignation or active co-operation was requested.

The names of C. E. Leonard and of N. J. Colman were separately and similarly acted upon, and each requested to resign or become active members.

Moved by H. Eshbaugh that this board recommend Col. E. C. More for reappointment, and that we request the Secretary to notify the Governor of the action of this board to that effect. Carried.

Moved, by M. F. Doud, that the board do now adjourn to 10 A. M., of the 7th. Carried.

10 A. M., THE 7th.

The board convened agreeably to adjournment.

After an informal discussion of a communication from Mr. Moneghan, authorizing the board to offer at his expense, when proof is made, a reward of $100.00 for the proof that wheat turns to cheat, and a general discussion was made of farm questions; the board listened to the report of the Committee on Treasurer's Account, which was as follows:

Your committee appointed to settle with the Treasurer make the following report:

We find cash on hand Nov. 5, 1882	$1,306 62
Received by the treasurer from the State Treasurer	800 00
	$2,106 62
Paid out for bills and vouchers	569 01
Balance in treasury Nov. 8, 1883	$1,537 61
Nov. 8th, 1883, cash on hand	1,537 61
Paid out as per bills and vouchers	958 76
Balance in treasury Nov. 7, 1884	$578 85

[SIGNED] M. FAIRCHILD DOUD.
J. A. POTTS.

H. Eshbaugh moved that the report be received, adopted and placed on file. Carried.

Moved by H. Eshbaugh that the executive committee be authorized to call institute meetings, as thought desirable. Voted.

Moved by Dr. Laws that the work of the Secretary, in organizing a show of the farm products of the State be commended, and that the attention of the people of the State be called to the Fair and to the work of the Secretary in organizing the farm department of it. Voted.

Dr. Laws moved that a committee of two be appointed as delegates to the cattle convention to be held in St. Louis Nov. 19th.

Moved that President Walker and Secretary Sanborn be appointed delegates to above cattle convention. Carried.

Moved that any vacancies that occur, by resignation or otherwise, in the Board, receive the attention of the executive committee by a nomination for gubernatorial action. Voted.

Moved by J. R. Rippey that wood cuts of Chiltingham cattle in Agricultural college museum be made, if in the judgment of the Secretary the money can be spared, for insertion in the next Board report. Voted.

Moved by Mr. Doud that the Secretary be appointed Treasurer pro tem., with instructions to pay the expenses of the members in attendance at this meeting. Voted.

The Secretary was informally requested to see that each member was furnished a copy of the laws presented by the Legislative Committee to the General Assembly. Voted.

On motion of Mr. Potts, the Board adjourned *sine die.*

MEETING OF BOARD AT MEXICO, NOVEMBER 25, 1883.

A Farmer's Institute meeting was held at Mexico, on above date, extending over three sessions: morning, afternoon and evening.

A brief synopsis of proceedings, only, will be given, as the papers presented were published in the last Board report, the delay in printing affording an opportunity for their insertion.

MORNING SESSION.

Members present: Hon. John Walker, Hon. N. J. Colman, M. F. Doud, Esq., J. A. Potts, Esq., J. W. Sanborn, Secretary.

On motion of Col. Colman it was voted that the Treasurer pro tem., J. W. Sanborn, be instructed, in connection with the President, Hon. John Walker, to close up the account of the appropriations by the General Assembly, now in the hands of the State Treasurer, by requisition for the same, and that they be authorized to pay out the same on the order of the Board.

Moved that the Board recommend the appointment of a new member from the northeast part of the State in place of K. M. Lear, whose position is forfeited by the authority of section 10 of the by-laws. Carried.

On motion of J. W. Sanborn, the Board voted to instruct the chair to appoint a committee to draft resolutions asking for the appointment, by President-elect Grover Cleveland, of Hon. N. J. Colman, a member of this Board, as successor of Hon. George B. Loring, U. S. Commissioner of Agriculture.

The Chair appointed Messrs. Sanborn and Potts members of this committee.

On motion of M. F. Doud, the Secretary was instructed to correspond with the Secretaries of other State Boards of Agriculture, requesting the co-operation of the Boards they represent in securing the appointment of Col. Colman to the above named office.

An open session followed, and President Walker very clearly reviewed the functions of the plow in tillage and the style of plow to use, advocating the sulky plow. This able address awakened an interest that extended the debate throughout the forenoon

AFTERNOON SESSION.

Hon. N. J. Colman presented, ably, the demands for a change of our system of farming to more grass and creamery butter. Much debate followed this talk.

Dr. Cressy followed with a description of "animal diseases," for which, and other papers, see annual report for 1883.

EVENING SESSION.

"Animal nutrition" was first discussed by the Secretary.

M. F. Doud discussed the mistakes of farmers and their legislative needs, receiving the close attention of the audience.

General remarks were made by Col. N. J. Colman, Col. Hutton and Dr. Cressy, after which the Board adjourned *sine die.*

ANNUAL MEETING OF THE BOARD AT COLUMBIA, MO.

AGRICULTURAL COLLEGE ROOMS,
COLUMBIA, Nov. 4, 1885.

In accordance with the law, the Board met at its rooms in the Agricultural College building at 10 A. M., Nov. 4th.

President Walker in the chair.

The president opened the meeting with highly appropriate remarks, of which only a mere synopsis can be given.

I regret that all the members are not present. It being customary for the President to lay the condition of our agriculture and of the crops of the year before the members, I will state, with regret, that the wheat crop is short; corn is off in expected yield, yet is a good crop, and is of fair quality; grasses are luxuriant; fruit scanty, but the varieties have been greatly diversified in the last few years.

The funding of the county debts has progressed rapidly, and in consequence, the burdens upon the farmers have been greatly reduced, and in the unsettled counties of the State is felt to be a great relief. These unsettled counties are rapidly filling up.

I would observe that agricultural machinery is not advancing as rapidly as it did fifteen years ago; but what we have is being perfected, and the last St. Louis fair has shown the great advance of tools which have revolutionized the relation and character of farming, and is marking out a new era in farming.

While the art of breeding has advanced materially, that of feeding has been neglected and is stationary. A bushel of corn is no more effective to-day than formerly.

It is the duty of this Board to urge the Legislature to found an Experiment Station at Columbia, provided with cooking and grinding tools, and all other appliances necessary for making continual tests; at which station the influence of heat and cold, etc., upon feed can be tested.

It is my firm conviction that this matter of feeding is one of the deepest concern to us.

The farmers' meetings, inaugurated by this Board, were not well attended at first, but there has been a growing interest in them, and their repetition in any place has uniformly drawn larger crowds.

I believe that Sec. 10 of our by laws, which provides for the retirement of members who may be absent from two successive meetings of the Board, is a good regulation, and one that should be enforced.

Since agriculture should engage largely the attention of the Governor, it is highly desirable that he should be a member of this organization in order to familiarize himself with that subject and its interests. Although bread should be put before education, yet the Commissioner of Education should be a member of the board, and thus ally the school and farm interests.

The President of the State University being the representative of higher education in the State, is, for the foregoing reasons, very properly a member of the Board, and it is peculiarly fitting that the Dean of the Agricultural College, the head of the school for the professional education of farmers, should be a member. Our organization is therefore a good one. The life tenure by which members of this Board hold office, was assaulted at the last session, and a bill asking for its alteration was introduced in the last General Assembly, but was defeated on account of other provisions in the bill.

The appropriations for the Board have been increased, and the printing and binding of the reports of the Board have been provided for. These aids have greatly strengthened the Board and enlarged its field of usefulness. The crop reports published under the auspices of this Board have been favorably received, both at home and abroad, and I sincerely hope that they will be continued successfully.

The Board, as the champion of agricultural interests, should insist on the appropriation by the General Assembly of at least $15,000 for founding an experimental station, thus providing means for carrying on all tests of interest to the farmer.

The difficulties of the Board in procuring legislative assistance have been greatly increased by the changes in the Assembly, the new members of which have, at each session, to be educated up to a proper appreciation of our needs. There were only fourteen old members in the last General Assembly, and but twenty-three in the preceding Assembly.

I have tendered my resignation as a member of the Board to the Governor. It has been accepted and will go into effect to-morrow. I have taken this step with reluctance, but believe it to be my duty in order to afford a chance of rotation and to introduce fresh blood.

Hon. W. E. Colman: I have been deeply interested in the remarks of the President, and believe that studied scientific work on the farm is increasing and attracting wide attention. Many men go through college with no knowldge of the earth they handle. An attempt has been made to introduce agricultural education into the common schools, and I believe if the matter could be fostered in the schools it would add much to farm progress. I am satisfied that the President is right in his remarks on feeding. From personal observations made while traveling over the State, I find that fodder is now considered as of little value and is generally wasted.

Our orchards are neglected and left to be preyed upon by enemies. I recently noticed where an orchard, of fourteen years standing, had perished, while another of the same age, that had been properly tended, was in fine bearing condition.

There are a mass of facts of primary importance, yet they cannot now be taught in our common schools; our teachers are not prepared for the work. Our farmer's meetings and the bulletins of our agricultural farm aid in spreading a knowledge of such facts, and are doing good. Complaint is now made that too many branches are taught in the common schools, and that in consequence the pupils receive only a smattering of each. I believe it would be better for men to study only that which they intend to use, and that Latin and higher mathematics should give way to special studies. Physics, for instance, is of practical importance to the farmer in the handling of machinery, etc., and such of its laws as are applicable to the farm should be taught. When these laws have been made familiar, men set to work studying how one man can do the work of two.

The science of feeding should be better understood, and seed should be studied more. Why wheat *runs out* has not been satisfactorily explained, yet our farmers have constantly to introduce new varieties of wheat. St Charles county formerly grew Tappahannock almost exclusively, now none is to be found there, but bearded Mediteranean is sown more extensively than formerly. In studying seeds, the question of quality of the product enters conspicuously, and demands investigation.

Mr. Sanborn: The increased appropriation alluded to by President Walker has been of invaluable aid to the Board. It has enabled us to increase our list of crop correspondents, and to enlarge the monthly crop report system that was inaugurated last year for the first time in the history of the Board, on inadequate funds. We now have a large and efficient corps of correspondents, numbering nine on the list of each county, although we do not get answers from them all, each month, as yet. We hope soon to secure constant returns from most of this number, per county. Nov. 1, twenty three questions were asked of fifty reporters to this office, making 23,000 figures to be transferred, summed up in averages for each county, and then the ratio of each county average on its present prospects to the previous yield of the State is ascertained, from which is deduced the present prospect of crops.

These reports are now accepted as authority. This work has brought the Board in contact with the public more than heretofore, and enlarged its general work of correspondence in answering questions in agricultural practice to farmers at home, and regarding the resources of the State to those abroad.

The farmer's meetings instituted three years ago, have grown in popularity, and we now have more calls than we can respond to.

The President and Mr. Coleman have alluded to the Agricultural College in terms of interest. It may be fitting for me to say that the college is progressing favorably. The public are manifesting an increased interest in it, while, within, it is gaining ground. We have now a museum of much interest and value, which was collected in New Orleans at the Great Exposition and elsewhere. Our means of class room illustrations have been much added to.

The Horticultural Department was never in so good order, and contains invaluable means of illustration.

During the past year very important improvements have been carried forward on the farm, and the radical system of farming inaugurated three years ago has begun to show its influence on the fertility of the farm and on its revenue. Not one dollar, directly or indirectly, has been received from any source save from the actual earnings of the farm for two years. These two years have been years of decline in values of farm products, and of disaster to farmers. Yet, the college farm, which pays its own labor bills, has expended over $1,000 this year, and nearly as much last year in removing stumps by the hundreds from its fields, building fences, grading out a race track cut through it, and in grubbing a thick growth of buck bushes and young white oak growth in its pasture covering 200 acres of ground. The sunlight let in has greatly increased the capacity of the pasture and the growth of its steers. Its crops have all been good, including wheat, while corn has risen to a big yield.

Under its system of rotation, work is diversified, requiring but little help, while greater crops under manuring are received.

This is a great stock State, in fact, the wealth of the State rests upon our stock interests. Yet this great interest cannot have experiments carried on in its interests at the college farm from want of buildings on it. This manifest want, I trust, will soon be provided for by the State, in accordance with the views advanced by the gentlemen who have preceded me.

Moved, by Mr. Colman, that $33 be appropriated to pay the National Department of Agriculture for cuts of thirty-three grasses. Voted.

Moved, by Mr. Colman, that the Warden and Inspectors of the State Penitentiary be requested to furnish convict labor for the clearing up and putting in order the State farm. Carried.

Moved, by Mr. Sanborn, that Mr. Colman be appointed a committee of finance to audit the Treasurer's account. Voted.

Moved, by Mr. Colman, that the Treasurer of the Board be directed to make and present his bond, and present it to the meeting of the Board to be held the first Thursday in January, 1885.

Moved that the positions on the Board, of M. K. Lear, O. E. Leonard and Wm. Hall, be declared vacant, in accordance with by-laws, section 10, of the Board, and that all future appointments be recommended to be made for the term of four years only. Carried.

The Committee on Finance reported that it had examined the Treasurer's accounts, and approved the same. Accepted.

On motion of Mr. Colman, a recess was taken to 2 P. M.

AFTERNOON SESSION.

President Walker in the chair.

On motion of Mr. Colman, the Secretary was authorized to call a number of farmer's institute meetings during the coming winter, not to exceed ten. At these meetings speakers from abroad may be invited to deliver addresses, receiving for their services their expenses. The expenses of above meetings are not te exceed $700. Adopted.

Moved, by Mr. Walker, that when the Board adjourn, that it adjourn to meet on the first Thursday of January, at a farmer's meeting to be held at ———. Voted.

Moved, by Mr. Colman, that the Secretary be authorized to print the map of the State, shown to the Board, as a part of his next annual report. Adopted.

Moved, by Mr. Sanborn, that Prof. S. M. Tracy be allowed a sum, not to exceed $25, for traveling expenses in collecting a list of the plants of the State for the next annual report of the Board. Voted.

Moved that the following gentlemen be requested to accept positions on this Board, on condition of active co-operation, and that if they signify their willingness to enter upon this work, that their names be forwarded to the Governor, with the recommendation that they be appointed as members of the Missouri State Board of Agriculture for the term of four years: Dr. W. H. H. Cundiff, J. R. Estil, J. B. Thompson, Hon. V. Marmaduke, J. L. Erwin and Hon. E C. Moore. Voted.

On motion of Mr. Sanborn, the Board adjourned *sine die.*

J. W. SANBORN,
Secretary.

ERRATA.

Inasmuch as the following article, by the Secretary, has been very unfortunate, the greater part of the typographical errors in the Report occuring in it, the errata is introduced at this place:

Page 38, first paragraph, 3d line, for “fifty” read “1050.”
Page 39, eleventh paragraph, 3d line, for “———” read “Fulton.”
Page 42, first paragraph, 1st line, for “wane” read “wave.”
Page 42, first paragraph, 7th line, for “411 bu.” read “4.11 bu.”
Page 44, second paragraph, 5th line, for “cupping” read “cropping.”
Page 50, first paragraph, 5th line, for “19 bu.” read “1.9 bu.”
Page, 57, second paragraph, 4th line, leave out “ash.”
Page 57, third paragraph, 11th line, for “find” read “feed.”
Page 62, third paragraph, 3d line, for “leaked” read “leached.”
Page 62, third paragraph, 4th line, for “life” read “matter.”
Page 62, fifth paragraph, 2d line, for “1,200 and 1,400” read “12,000 and 14,000.”
Page 64, third paragraph, 1st line, for “liquid” read “solid.”
Page 66, first paragraph, 4th line, for “Renhallows” read “Penhallow.”
Page 114, seventh paragraph, 2d line, for “too” read “to.”
Page 162, first paragraph, 1st line, for “Culore” read “Culvre.”
Page 207, first paragraph, 1st line, for “1889” read “1880.”
Page 238, fourth paragraph, 2d line, for “2,000 tons” read “20,000 tons.”
Page 240, sixth paragraph, 5th line, for “velveity” read “velocity.”
Page 274, third paragraph, 2d line, for “Chas. Nebeau” read “Chas. Newbold.”

FERTILIZATION.

To a large proportion of our farmers, the consideration of crop feeding will appear premature for Missouri. After a careful survey of the present status of our farming, I offer some suggestions on this subject for the following reasons, to wit:

First—Because numerous letters of inquiry addressed to this office, mark a wider interest in the subject than appears on the surface, and often reveal a misconception of first principle that justifies, in connection with the general interest manifested, a presentation of the subject.

Second—Because the marked influence upon crop yields of cropping without manuring, is generally very greatly underestimated.

Third.—Because the period in our agriculture has arrived when it has become the most important single factor in the future of our farming.

Fourth—Because less consideration has been given this subject than any other important farm process.

EFFECTS OF CROPPING WITHOUT MANURING.

Deterioration of crop capacity has been the universal result, in all ages and in all countries, of cropping without manuring, except where nature provides plant nutrition in annual floods.

This country, especially the western section of it, which came to us with the legacy of ages of accumulating fertility, affords a brilliant example of the readiness with which genius can spoil Nature of ages of endeavor to produce a fat soil. In the bright light of the statistical machinery of the day, and especially of that of the United States, exhaustless fertility has proven but the merest fable, and ought no longer to deceive any one.

There is not a State or Territory under the stars and stripes, from the Atlantic to the Pacific, but whose soil, under unfertilized culture, has witnessed receding crops per acre. Every State has witnessed a wane of spoilation farmers skim the cream of the soil and move westward to repeat the process. In the last report of the Board of Agriculture, I presented a table showing the decrease of crops per acre for several of our States in periods of five years from 1862 to 1882. Even boastful Kansas, now in its cradle of infancy, notwithstanding the new acres constantly being added, has seen her yield of wheat per acre decrease in fifteen years 411 bushels, or 410 for each 100 acres raised. Missouri wheat is a close neighbor to these facts, while California, not then named, and the State which popularly could furnish the bread for the nation, has witnessed her crop recede from 24.2 bushels in 1862 to 13.4 bushels per acre in the years from 1880 to 1884. Dakota, whose soil by reputation is all cream to the bottom and no bottom to its soil, has traveled the same painful road, and now gets an average of 15.5 bushels per acre. Painful, because depletion of a soil is an impoverishment of a State and of each individual engaged in the process, not only in purse but in the dwarfing of the mind.

Iowa joins Missouri in the downward course of its corn crop and registers 3.4 less wheat and 5.9 bushels less corn per acre than in 1862 to 1867.

The decline of the fertility of our soil, all students of history and of science expected, but few, however, were prepared for this rapid depletion of the hoardings of ages. We are bound to recognize it as a fixed fact.

THE KEY TO THIS DEPLETION.

Exhaustion of soil is easily explainable by a few fundamental facts that are likewise the alphabet of fertilization.

A plant is a structure into which is woven fourteen distinct materials, and without the presence of ten or more of them no plant can be grown to maturity; the absence of any one of the ten suggested being fatal.

These fourteen materials, in technical farm language, are oxygen, hydrogen, carbon, nitrogen, phosphorus, sulphur, lime, magnesia, potash, soda, iron, manganese, silica, and chlorine. Several of those materials are familiar to farmers—such as potash, lime, sulphur, phosphorus, and carbon (coal). No plant can be grown without them.

These materials are gathered from the soil and the air. Those that are gathered exclusively from the soil are phosphorus, sulphur, lime, magnesia, soda, potash, iron, manganese, silica, and chlorine.

The following analysis of a Missouri soil will show the amount of these materials to be found therein:

Silica (soluble)	.083	per ct.
Peroxide of iron	3.4596	"
Alumina	4.9748	"
Lime	.3884	"
Magnesia	.4543	"
Potassa	.6124	"
Soda	.3096	"
Chlorine	.0072	"
Sulphuric acid	.0302	"
Phosphoric acid	.1908	"
Water	1.1407	"
Organic matter	7.3316	"
Insoluble in acid	81.3985	"

From these materials, then, the plant must obtain its mineral matter (matter that is left as ash when a plant is burned). Why are they not sufficient for all time, inasmuch as the crop does not bodily remove all the soil, but leaves a vast store-house from which to draw future supplies? Experience has given the easy answer, namely: That the great bulk of this matter is not soluble in water. If it could be easily dissolved like salt and sugar the globe would rapidly melt away under our feet, hence the soil is made very slowly soluble, and by weathering a life time it furnishes but a few hundred pounds of available matter, while an acre of the soil whose analysis is given, contains about 8,000 pounds of phosphoric acid, yet in growing the State average of wheat, 11.8 bushels per acre, it does not furnish yearly over nine pounds of this material, of which probably not one-half is due to the decompositions of the year.

As our crop of wheat should reach the level of good English farmers of forty bushels per acre, it will be seen that we shall have to assist nature.

Many soils do not contain over 4,000 pounds of phosphoric acid per acre, and analysis by Dr. Lyton reveals soils with less than 3,000 pounds per acre within the first foot of soil, the area to which the other figures of the total amount per acre refer, and within which the nutrition of wheat is almost all gained. One hundred good crops of wheat after the English standard, would completely exhaust this area of the above acid.

But to show what a small proportion of plant food is really available in a soil, I will cite the use of 44 pounds of nitrogen per acre on the college farm as increasing the yield of wheat, over a section not receiving any fertilizer, by 11.6 bushels and the straw by 1,090 pounds. I have had 46 pounds of phosphoric acid and potash increase potatoes in yield by 80 bushels, and 64 pounds of potash, corn by 36 bushels and the fodder in like proportion.

Forty-four pounds of nitrogen mixed with 2,000,000 pounds of soil have more than doubled a crop of wheat. This is 46.464 pounds of soil for one of fertilizer. Verily, Nature's ways are marvelous.

There is, then, nothing mysterious or unexpected in our lessening crops, but all is in accord with the facts of science. With mathematical certainty the blighting curse of poverty may be predicted for that farmer or group of farmers who, from either infatuation or indolent indifference, pursue the cupping course of the past. Indeed the mistakes of the present generation in this respect are plainly visible in the present condition of our agriculture. Who boasts of the profits of wheat at 11.8 bushels per acre, of corn at 26.6 bushels, of oats at about the same rate? Yet these are our State averages.

The story of these yields is told in the character of our country roads, homes and surroundings, including price of our farms in the older sections.

RENOVATION OF FARMS.

How shall we farm on the ascending scale? By intelligent rotation of crops, stock feeding, tillage, seed breeding and fertilization.

Fertilization only can now receive attention.

Fertilization may be accomplished by several systems, only two of which will be presented—plowing in of green manures not being generally or to any considerable extent advisable—chemical farming, while being successful, is not yet economical except in special cases, while fallowing belongs to a low type of farming.

INDIRECT FERTILIZERS.

These are fertilizers whose action, or office, is not usually that of a direct food, actually entering into and nourishing the plant. They aid the plant by dissolving the materials of the soil that the plant needs and furnishing food in quantities greater than it can get when unaided.

To make this important matter more clear, it may be stated that a great number of experiments in several countries have shown several facts that are accepted as demonstrations, and acted upon in practice.

First, that from 90 to 99 per cent. of the weight of plants is gained from the air in oxygen, hydrogen and carbon. These are taken up mostly in the form of water through the roots, from which the plant gets its oxygen and hydrogen, for of these is water made, and in the form of carbonic acid through the leaves, these organs (the leaves) decomposing this material, it yielding its carbon to the plant. Thus the plant gets most of its growth from these three materials, which we need not add to soils.

Again, plants have been grown with well matured seeds in pure distilled water or burned sand, by adding these fourteen materials to the water or sand. Each one of these materials would be left out in turn of one of many pots of water containing plants, or one lot would be without potash, another without soda, and so on for each element.

The result of all these trials have shown that soda, chlorine, manganese and silica are of such uncertain value to the plant and so abundant in the soil that all plants can get them in abundance from all agricultural soils.

Furthermore, field tests for forty years have convinced the farming world that almost all soils contain sulphur, lime, magnesia and iron in abundance for the wants of crops. Then we come to the position that eleven of the fourteen materials nature provides in abundance, leaving only nitrogen, phosphoric acid and potash for us to add. Of these materials, one, two and three are required, according to the nature of the soil—that is, some soils require only one of these, others two, and a third class all three.

The writer has farmed on three farms. The first gave good results with only phosphoric acid; the second required potash badly, and was almost indifferent to the other two; while this farm for wheat, asks only for nitrogen. The following experiment made at the Missouri College Farm, illustrates this fact and shows a good method of making, by the plant itself, a test of the needs of a given soil. The system is called a plant analysis of the soil, and is a test of the needs of the soil for each material:

No of plat........	FERTILIZER USED.	Yield of Wheat. Bushels........	Yield of Straw. Pounds........
1	330 pound Sulphate of Ammmonia 100 pounds Muriate of Potash 140 pounds dissolved Bone Black	12.5	2120
2	15 tons yard manure	16.2	2395
3	220 pounds Sulphate of Ammonia 100 pounds Muriate of Potash 140 pounds dissolved Bone Black	15.6	2360
4	No manure	4.	1040
5	110 pounds Sulphate of Amonia 100 pounds Muriate of Potash 140 pounds dissolved Bone Black	10.	1925
6	100 pounds Muriate of Potash 140 pounds dissolved Bone Black	8.8	1330
7	140 pounds dissolved Bone Black	8.8	1570
8	No manure	8.8	1400

As only nitrogen, phosphoric acid and potash are regarded as likely to be deficient in a soil, it follows that the favorable action of other substances is due to some other reason than their action as foods themselves. In fact, their good offices consist in relieving these valuable materials, nitrogen, etc., from their combinations that are insoluble in water, thereby forming soluble compounds. That certain materials have this action we have many ways to show in the class room; indeed, any one can readily ascertain this fact by putting pounded bones in ashes and keeping the ashes moist.

Lime, salt, plaster, etc., are among these indirect fertilizers. The use of lime as a fertilizer is of very ancient practice, and is yet the resort of many farmers. Perhaps no fertilizer is more subject to ill considered use than lime. It is generally the first resort of a decaying agriculture, due to its low price, ready action and availableness.

Lime is composed of the following parts, to wit: 40 parts calcium to 16 of oxygen. But as we do not get absolutely pure lime, but lime in connection with magnesia and other matters, I will give an analysis of lime as made by the Connecticut Experiment Station:

Lime	70.12	per cent.
Magnesia	.67	"
Oxide of Iron and Allumina	.20	"
Cabonic Acid	7.76	"
Water	20.50	"
Insoluble in Acid	.28	"
Undetermined matters and loss	.47	"
	100.00	

Some samples of lime contain over one-third part of magnesia.

I will consider lime under three heads, namely:

First, forms; second, functions; third, value and use.

FORMS OF LIME.

First, caustic lime: This is burned limestone, and results from the driving off by heat of the carbonic acid united with the stone. The amount of carbonic acid thus disengaged varies according to the purity of the stone, but a good sample will contain 44 per cent. of this acid.

Second, hydrated lime: This material all are familiar with, and it results from the great affinity of lime for water, which leads it to absorb moisture from the air, to swell up and drop apart into a fine dry powder, weighing more than the caustic lime. Hydrated lime properly, is lime which has absorbed eighteen parts water for every fifty-six parts lime, as in slaking. The form of lime now considered has absorbed enough moisture and carbonic acid to lose somewhat of its caustic properties, but is in a better form to use.

Third, ground lime or carbonate of lime: This material is simply the stone ground without burning, and hence contains all of its carbonic acid, or properly, 45 per cent. Prof. Johnson's analysis showed 43.54 per cent. of carbonic acid.

WHICH FORM IS BEST.

This depends upon our soil to some extent. If we wish for the lime alone we get the most in the first form, for, by the analysis given, a ton contains 1,402 pounds of lime. The second form will contain less by 200 pounds or upwards, while the third form will contain lime with the carbonic acid driven off, which amount, in a pure limestone, would make about 800 pounds difference.

Prof. G. H. Cook gives a case of limestone of 550 pounds lime per ton, and limestone burned of 978 pounds of lime. Thus the first form for lime would be much the cheapest. If the lime is rich in magnesia and the soil needs it (magnesia), which fact does not ordinarily occur, then a magnesian limestone might prove profitable.

The practice of grinding limestone and selling the product as the equal or superior of the former has been somewhat common of late. The burned lime is richer in lime, and much more active, as the latter is very slowly soluble and quite inert in the soil; and, I believe, undesirable to purchase.

THE FUNCTIONS OF LIME.

(1) Plant food.
(2) Physical agency.
(3) Chemical agency.

(1) Its nutritive agency will be best contemplated with its amount in the plant before us:

The ash of hay is 22 per cent and upwards lime.
" " clover is 34 " lime.
" " carrots is 10 " "
" " the beech tree is 54 per cent lime.

This large amount of lime in the ash of our grasses and clover indicates its possible need, and Ville, the brilliant investigator, recommends its use in all of his chemical formula. We might suppose that on a limestone soil, such as covers most of Missouri, its need would not be felt, yet lime is freely used on the chalk and limestone soils of England, and on limestone soils of the Middle States.

The more ready solubility of lime, as compared with potash and phosphoric acid, carries it from the surface soil to the subsoil, or away in our streams, hence, lime is always an abundant constituent of water from limestone soils, and leaching may leave a limestone soil on its surface not over rich in lime.

The sum of experience, however, teaches us that potash and phosphoric acid are almost always first deficient in the soil, and in the resupply of these materials they are given in forms that contain lime, which lime goes with these materials without charge; so that practically, we concern ourselves but little about the lime supply. Again, when feeding yard manure to a soil, lime is furnished in abundance.

In short, the position is this: that before the need of lime is felt in the soil, other materials should be furnished the soil, that are more in need and whose use supplies the lime prospectively needed.

(2.) The physical effect of lime on soils is often favorable; especially so on tenacious clays. Sir John B. Laws, whose experience is exceedingly valuable, calls attention to the influence of lime and chemicals on clays that are compact, they causing clays to become more open to percolation of water, more easily handled and earlier. This effect is frequently noted by others. Schloesing finds that lime salts coagulates kaolin, a material characteristic of clay soils, separating the atoms of clay from the water so as to make more open the pores. Heavy soils, then, are benefited by lime in their physical properties.

(3.) As a chemical agent, lime neutralizes injurious acids of soils and gives rise to a better class of vegetation. Instances are recorded of its radically changing the value of a farm by combining with injurious acids and forming harmless salts.

Its decomposing effect on the soil is its great function as a fertilizer. The insoluble organic matter is in its presence decomposed and made available to the plant in water solutions. Food does not enter the plant in solid particles visible to the eye or to the microscope, but like sugar in water, solved by which medium (water), it gains entrance to the roots.

This decomposing action of lime is made use of by tanners in removing hair from hides. We can note its effects by mixing it with yard manure, when the odor of escaping ammonia will soon be noted. For this reason it should not be mixed with manures, as is often done.

(3.) Its use and value. (*a*) Its use: Caustic, or burned lime, from as pure limestone as can be got, will be preferable to ground limestone. Caustic lime being in lumps, can not be spread evenly. We can allow it to air-slack and spread it in damp weather, as the fine dust is very offensive to use.

In sections where it is burned and drawn directly to the field and used from the kiln, it is thrown out of the cart into heaps and allowed to slake by showers or from the dews and atmospheric moisture, when it is spread.

The amount used varies from one ton per acre up to several. The old custom was, large amounts, but the later and more sensible practice is small amounts and often. This amount must vary with the land, the more sandy the land the less lime, and for hard, wet clays, larger amounts.

To heavy, sour lands and to lands rich in organic matter, should its use be mainly confined. It is a rapid decomposer of organic matter; and light lands are afflicted by the need of this factor for the retention of water and of added plant food.

(*b.*) The value of lime is a problem for contention. Harris in his work on "Manure," praises lime and in his writings, gives cases of greatly increased crops; Sir John B. Laws speaks favorably of it; Villes gives it a prominent place; Cornell University Experiment Station found an increase, for 200 bushels per acre of lime, of 19 bushels and 5 pounds of corn, 6 bushels of oats; and for 80 bushels of lime per acre, 3¾ bushels of wheat. Many instances could be given of its beneficial use, but I need not multiply, for its use has come to us from Roman times and has been practiced by the best of farmers. As it is not universally useful, I refer the reader to previous remarks for lands upon which to use it.

But its "Bowl of pleasure is poisoned by reflection on the cost thereof." "It enriches the father and impoverishes the son," is a truthful saying unless very intelligently handled. Why so?

First.—Because it does not add to the food material of the soil, but hastens its decrease. It is paying for an agent to destroy rather than build up the soil.

Second.—It will, in its decomposition of the soil, lead to an increase of the materials that leach from the soil and evaporate into the air, especially so if the ground is not under grasses. It is because of this liability to loss that I recommend small dressings of it, as 200 bushels per acre of caustic lime will set free more ammonia and soluble salts than the plants can at once take up, and a loss from rains will follow.

Lime is a dangerous agent in our hands. We are on the robbing trail and apply our genius to extort from the soil all we can, and return nothing. We have already gone too far in the process. Shall we now use this ready means of putting a finishing blow to the best hopes of our children, which surely rest in a fertile soil? With make-shifts I have no toleration, and believe that there is one true principle always to be observed, to wit: Aim in everything to make the farm richer, and therefore stronger each succeeding year. This policy leads to happiness and wealth; the other policy to poverty and mental sluggishness. A decaying agriculture has in all times marked a nation's impoverishment and final prostration.

I would give a lukewarm advocacy of the use of lime to those farmers who will feed out the bulk of the crops raised, and provide suitable means of preserving the manure made for return to the soil. I seek to make as great an exhaustion of the soil yearly as possible in big crops, but make more than a corresponding return annually to the soil, that greater exhaustion may occur the following year.

PLASTER, OR GYPSUM.

By composition plaster is, in 100 pounds.

Water	21	pounds.
Sulphuric acid	32.5	"
Lime	45.5	"

Plaster is known to chemists as sulphate of lime.

While containing about as much lime as some few samples of lime, rich in magnesia, it is quite distinct from lime in its action. The former article, or lime, has alkaline qualities, coroding whatever it touches of organic matter, while plaster is a salt, having neutral qualities, and will not injure hands and garments as will lime.

It will be observed that it contains none of the materials counted as likely to be deficient in the soil, and hence is an indirect fertilizer aiding the plant from some functions peculiar to itself. Its sulphuric acid is made up of oxygen and sulphur. The first material, plants easily gain from water, and the second is in only small amounts in plants. Thus it requires 42 bushels of wheat to contain one pound of sulphur.

The character of the good offices of plaster has been a matter of much dispute. Observing valuable effects in dry seasons, it was for a long time held that its absorption of moisture was a leading characteristic. But it is now known that its absorbing capacity for moisture is very low, being even below that of the soil itself. Requiring a very large amount of water to dissolve it, in fact, it is very slightly soluble in water, it may in the pores of the soil decrease evaporation of water and thus conserve the moisture of the soil.

But its main beneficial function must rest upon its chemical effects as a decomposer of soil and as a fixer of ammonia.

In its latter capacity it is used about stables to keep down odors. Its action has the following explanation: The corbonate of ammonia that escapes from the manure of stables is made up of carbonic acid and ammonia, while plaster is made up of sulphuric acid and lime. The carbonic acid of the ammonia exchanges places with the sulphuric acid of the plaster, and we get carbonate of lime and sulphate of ammonia, or there is a decomposition of the old compounds and the acids by stronger affinities, exchange places.

The sulphate of ammonia, which is formed, is a salt and not volatile.

Plaster is regarded as performing this same office in the soil, and in dry weather doubtless fixes the ammonia from the air that may be circulating in the soil. In dry weather corborate of ammonia is likely to escape from the soil and the presence of plaster serves to fix it.

In the absence of any of its constituents from the soil, of course it may feed the plant direct.

THE USE OF PLASTER.

In dry seasons it is found valuable, and on dry soils it is often praised. But being a decomposer its action on rich soils will be most effective.

Being a very cheap fertilizer, I recommend a test of its value as the true way of ascertaining its worth, for its use has been commended for all sorts of soils, while it is equally certain that its effects varies with soil and season in a mysterious way, on some soils being of but little valne. In my experience I have always found it increasing the crops, and have personally known of very radical gains from the use of from 100 to 200 pounds per acre, broad casted. It is a special fertilizer for clover and is so known. Its use on pastures has a tendency to bring in clovers. It is frequently used on pastures and gives a good sweet herbage. On corn it is either drilled in or put on over the hill, at the rate of 100 pounds per acre, or a spoon full to the hill. At the Cornell University it gave 6⅔ bushels of oats and nearly the same of corn increase for its use.

Its use is not to be condemned as severely as that of lime, for it is conservative of fertilizing matters and gathers ammonia from the air to a slight extent, prevents its waste into the air and subsoil; hence, is to be commended when used in conjunction with manures and a recuperative system of farming when experience, first obtained, teaches its usefulness. On the other hand, it is a decomposer of soil and if used in growing sale crops, in distructive farming, will leave the land poorer after a short period of use. Such has been experienced and such is sound theory; both here agree.

SALT.

This material is composed of chlorine and soda, and is known as chloride of sodium. Its composition, in the light of previous remarks, will at once reveal its true nature as a fertilizer. None of the indirect fertilizers are so thoroughly unfitted to feed the plant direct as common salt, for the value of chlorine and the value of soda in plant nutrition is slight, comparatively, and they occur in ample amounts in the soil.

As a soil decomposer, and as a regulator of moisture in the soil it certainly is often valuable. Such eminent authorities as Voelker, Johnson and others have found it valuable. Prof. Roberts, of Cornell, found that soil treated with salt contained more moisture, which doubtless was due to retardation of evaporation rather than to absorption of moisture from the air. It is reputed to be especially valuable, for marine plants. Asparagus is treated with it with benifit. Wheat of staple crops, responds quite as favorably as any hay crop to its use, one to five bushels increase for 100 pounds salt being expected. It is used in this small amount because in larger quantities it is poisonous to the soil, as all well know, it being often used to kill obnoxious plants.

Extensive quotations could be given of experimental tests with it—one will suffice. Prof. Henry, of the Wisconsin Agricultural College, received 5.9 bushels increase of oats for its use, and 1040 pounds of straw; 150 pounds were used. He remarks that the straw was brighter and stiffer. On tobacco it is reputed to injure the leaf, and on beets it injures the juice.

As a solver of insoluble compounds of the soil, it is known to act upon the phosphoric acid, lime and magnesia compounds, setting free these materials, or rather making new combinations that are soluble.

The refuse salt of Kansas and Nebraska are said by Prof. Goessman to contain sulphates of lime, soda and magnesia compounds. This being the case, this salt will have a higher agricultural value than purer kinds.

The use of salt comes under the same restrictions as the previous indirect fertilizers.

ASHES.

	Whole Ashes.	Second Sample.	Leached Ashes.
Potash	9.37 per ct.	4.66 per ct.	1.26 per ct.
Soda	1.92 "	1.20 "	.54 "
Lime	29.65 "	34.02 "	24.37 "
Magnesia	3 65 "	2.41 "	2.43 "
Iron oxide and alumina	5.21 "	1.41 "	2.13 "
Phosphoric acid	2.42 "	1.19 "	1.26 "
Sulphuric acid	2.46 "	.95 "	.10 "
Carbonic acid	16.57 "	19.25 "	14.99 "
Silica and sand	....	11.11 "	15.71 "
Charcoal	....	6.86 "	3.11 "
Water	....	13.42 "	32.02 "
Combined water and loss	....	3.52 "	2.08 "

The above analyses are from the Connecticut Experiment Station report. The second sample is given because more completely analyzed than the first, although Prof. Johnson, Director, explains that the sample had probably been affected by exposure to moisture.

Every element of plant growth is found in ashes. From plants they are and from their body they may rise again into plant life. Outside of barnyard manure ashes are peerless as a fertilizer. At once a great solver of soil and a great source of plant food. All ages have tested their value, and all soils have paid tribute to their influence.

A look at their composition and a recurrence to first principles is enough to convince anyone of their value. Two and one half bushels of good ashes contain as much potash as a ton of manure, and more of lime, magnesia, etc. Their composition varies with the trees from which they are derived. The right hand column displays the character of leached ashes as our mothers were in the habit of having them leached for the potash. The leaching process removes but little from them but potash. This loss is enough to raise a controversy as to their value among farmers. A long argument may be summed up in the statement that those farmers whose soil is rich in potash make but little distinction in their value, while those whose soil is deficient in potash place but little value in leached ashes. I have used them in large quantities for several years and attach a high value to them. In yearly tests I got thirty-one bushels of corn per acre more where ashes were used than where nothing was used, and over 1½ tons of corn fodder.

Ashes are a special fertilizer for clover, but are good for most crops. Although a little inclined to give a rough potato when used in large amounts. They are sown broadcast in amounts of from 25 to 100 bushels per acre for grass. In the latter amount their influence will be observed for years. In connection with bone meal they make a most excellent fertilizer for pastures. On account of their liability to throw off the ammonia of the bone meal, plaster is to be mixed with them, when the two are mixed and remain for a time in a pile for preparation for use.

We are guilty in Missouri of the unpardonable error of allowing most of this most concentrated of natural fertilizers to go to waste. If this oversight continues our sons will have a grave charge against us as they sweat to drag up the toilsome road of recuperation the farms we have plundered.

The ashes of every wood fire in the State are good for from five to ten bushels of corn, when rightly used.

YARD MANURE.

The excrement of domestic animals is the grand source of plant food, and the ingenuity of farmers should be exhausted to the extent of economy in the production, preservation and use of this plant food before other sources are looked for from beyond the farm. The brilliant genius displayed in presenting chemical fertilizers to the world as successful manures and their transcendant value to civilization, few estimate higher than myself. They will come to us at a later stage of the country's development, which is at no distant day.

The market value of chemicals (nitrogen, phosphoric acid and potash) give us a standard by which to estimate the value of manure from the yard. As I shall use those rates several times, let me state a few facts to make clear my meaning. We understand by chemical manures those fertilizers that are the product of art, as they are put upon the market. Nitrogen is derived from blood of slaughter houses, gas works, from natural deposits of nitrogen, salts, etc. Phosphoric acid is gained from bones, from mineral deposits in the earth and from other sources, while potash is mined in Germany from the bed of an old sea, and prepared for the market.

Some $30,000,000 or more of these chemicals are used annually in this country by farmers, who pay the following rates, namely: nitrogen, 18 cents a pound; phosphoric acid, 9 cents a pound, and potash 4 cents a pound. At first these sums seem fabulous, but we are to remember that most of the weight of plants—95 per cent.—is gained from the air. A 100 bushels of potatoes contain but 21 pounds of nitrogen, 35 pounds of potash and 11 pounds of phosphoric acid. These fertilizers will show the sums following as their cost:

21 pounds nitrogen at 18 cents	$3 78
35 pounds of potash at 4 cents	1 40
11 pounds phosphoric acid at 9 cents	99
Total	$5 17

We could afford to pay $5 for 100 bushels per acre more of potatoes. The writer has used large quantities of these materials at good profit in another State.

Inasmuch as farmers in some parts of the country are compelled to use these fertilizers, inasmuch as their use has extended to the Mississippi river in its westward advance wave, and inasmuch as we shall soon be using them, will it not be well to view the amount and value of these materials sent off from 100 acres of land, yearly, in the following crops:

	Nitrogen.	Phosp'ric acid.	Potash.
40 acres corn at 40 bushel, 1,600 bushels	2,048 lbs.	992 lbs.	2,400 lbs.
40 acres wheat at 15 bushel, 600 bushels	960 lbs.	480 lbs.	960 lbs.
20 acres grass at 1½ tons, 30 tons	750 lbs.	540 lbs.	1,740 lbs.
Total	3,758 lbs.	2,012 lbs.	5,100 lbs.

3,758 pounds of nitrogen at 18 cents	$675 00
2,012 pounds of phosphoric acid at 9 cents	181 08
5,100 pounds of potash at 4 cents	200 00
Total	$1,056 08

These crops this year will sell for about the following rates to-day, October 24, 1885:

Corn, 1,600 bushels, at 25 cents	$400 00
Wheat, 600 bushels, at 80 cents	480 00
Hay, 30 tons, at $5 per ton	150 00
Total	$1,030 00

These may not seem like sober figures, and possibly may raise a smile if they do not aid in raising larger crops. The warning is in language drawn from facts too plain to be called prophecy. That history will repeat itself here as unmerciful as elsewhere, and that the harder labor and more meagre returns of great poverty of soil will be our lot if we continue; and that our sons will inherit a worse misery than fell to the lot of the fathers; and, before regaining their just position, will have to pay for the chemicals named above, or will have to pay as much for the materials that we have sold in foods as we have obtained for the foods, giving away the fertility, for we scarcely get day wages for the foods sold at present rates per acre, at present prices. Our crop averages are below those of all of our neighboring northern and eastern States, while nature has given us a soil that exceeds theirs. Why is it that we are seven to ten per cent. behind these States? I do not hesitate to say that a great need is upon our agriculture. More dependence upon art and less upon nature is certainly called for, and in manuring pre-eminently so.

COMPOSITION OF MANURE.

The composition of manure is a very variable quantity, and wholly dependent upon the character of the animal fed and the food given, principally upon the latter. So great is this variation that the manure from some foods is worth several times as much as from others. The following table of analysis of several foods is given to show the variation in the proportion of the elements regarded as of value in fertilization.

This table is mostly made up from German analyses of food, which do not vary materially from ours, as given in Prof. Johnson's invaluable work, "How Crops Grow." We have not quite enough American ash analyses of food yet to construct such a table.

In the second table is given the amounts in a ton, and the value of those materials evacuated in the manure. Rating nitrogen at 15 cents, phosphoric acid at 7½ cents and potash at 3½ cents, sums less than given for chemicals, because manure is years in being exhausted in the soil and requires more labor in applying. However, let it be distinctly understood that I do not claim that the manure from a ton of hay is worth $5.30, as given in the table, but only according to market rates the value is there, and that the figures are relative, that is if the manure from feeding a ton of hay is worth $5.30, then the manure from a ton of cotton seed is worth $26.62. This being the case, everything else being equal, we should find the foods that will make the most valuable manure; this is an important point in feeding. In getting these figures, I assume that eight per cent. of the nitrogen of the food goes into growth of the beast and 92 per cent. into the manure heap, 20 per cent. of phosphoric acid into the beast and practically none of the potash. Really our animals do not grow in the winter, consequently throw off all these materials in full into the manure. I have proposed to consider them as growing, as they ought to, and will in good hands, and we are advocating good farming.

TABLE I,

Showing the amount of nitrogen, phosphoric acid and potash in 100 pounds of the following foods:

SUBSTANCE.	Nitrogen.	Potash.	Phosphoric acid.
Meadow hay	1.31	1.71	0.41
Red clover	2.14	1.95	.56
Potatoes	0.32	0.56	.18
Turnip	.26	.30	.10
Carrot	.24	.32	.11
Wheat bran	2.24	1.88	2.88
Linseed cake	4 58	1.29	1.94
Cotton seed meal	7.00	2.18	2.95
Winter wheat straw	0.32	.49	.23
Oat straw	.40	.97	.18
Corn fodder	.48	1.66	.38
Wheat	2.08	.55	.82
Oats	1.92	.42	.55
Corn	1.60	.33	.55
Peas	3.58	.98	.88
Field beans	4.08	1.20	1 16

TABLE II,

Showing the amount of nitrogen, phosphoric acid and potash in a ton of the following foods and the value of the manure from them after feeding:

SUBSTANCE.	Nitrogen.	Potash.	Phosphoric acid.	Value of manure per ton food.
Meadow hay	26.2	34.2	8 2	5.30
Red clover	42.8	39.0	11.2	7.94
Potatoes	6 4	11.2	3.6	1.49
Turnip	4 2	6.0	2.0	0.91
Carrot	4.8	6.4	2.2	1.01
Wheat bran	44 8	26.6	57.6	10.57
Linseed cake	90.6	25.8	38.8	15.72
Cotton seed meal	140.0	43.6	59.0	26.62
Winter wheat straw	6.4	9.8	4.6	1.50
Oat straw	8.0	19.4	8.6	1.94
Corn fodder	9.6	38.2	7.6	2.84
Wheat	41.6	11.0	16.4	7.10
Oats	38.4	8.4	11.0	6.25
Corn	82.0	6.6	11.0	5 30
Peas	71.6	19.6	17.6	11.62
Field beans	81.6	24.0	28.2	13.49

To give the above tables standing, I will add that the writer, in a careful trial, got 24½ bushels increase of corn and 3,400 pounds of corn fodder by the use of 1,000 pounds of cotton seed meal per acre. Bran is occasionally used for a fertilizer in the east and elsewhere. The English buy our rich nitrogenous foods, such as oil cake meal and cotton seed meal to feed to make rich manure. Rich food for rich manure is then our course, and I will assert, without fear of controversy, feeding of domestic animals is our cheapest source of manure.

Let us at least feed our own bran, shipstuff, middlings and oil cake meal. After the above explanation I will give analyses of average fresh good manure.

COMPOSITION OF CATTLE MANURE PER TON.

Water	1660.09	pounds.
Organic matter	280.90	"
Ash	57.6	"
Nitrogen	12.0	"
Potash	13.0	"
Soda	3.4	"
Lime	14.00	"
Magnesia	3.4	"
Phosphoric acid	5.4	"
Sulphuric acid	2.4	"
Silica	14 0	"
Chlorine	2.0	"

Yard manure, measured by the modern chemical theory, contains but 30.4 pounds of matter of very great moment, this being the amount of the potash, nitrogen and phosphoric acid in a ton. The water is no better than common water, while the organic matter is mostly oxygen, hydrogen and carbon, matters every plant can easily get. A man can carry out on his shoulder, in modern chemicals, the really valuable matters of a ton of manure. Hence, some have called chemical farming, snuff-box farming. Yard manure is very pretentious in bulk for its real material of value in plant nutrition.

PRESERVATION OF MANURE.

As big crops are based upon big manure heaps, and as the great bulk of our animal manures are wasted in the State, we meet, in this question of preservation of manures, a most important factor in its relation to our future welfare. Fortunately we have the mistakes of the past with the light of progressive experience to determine our course. There are two grand avenues of waste, namely: Leaching and washing rains and the waste of liquid manure.

Several experiments have been made to show the superior value of manure kept under cover, with the result that housed manure has invariably given the best results. Messrs. H. F. and A. Harwood, of England, according to their careful trial of weighed manures, as recorded in the report of the National Department of Agriculture for

1872, received four bushels of wheat more, or thirty-five bushels per acre for the manure from a covered yard, and forty-three and one-fourth bushels of barley per acre, or five bushels increase from the use of such manure Other accounts give greater differences.

Prof. A. Voelker, of the Royal Agricultural Society of England, has made the most critical investigations of the influence of weather and rains on unprotected manure yet recorded. He placed two lots of manure under exposure, one, as usually exposed, spread out in a yard, and the other in a large heap, and a third lot was left under cover.

3,258 POUNDS IN HEAP—COVERED.

	Weight.	Water.	Organic Matter.	Mineral Matter.	itrogen.
November 3	8,258	215.6	919.6	182 0	20.9
April 30	1,613	917.6	484.9	210.4	19.2
August 23	1,297	563.2	890.8	842.9	16.5
November 15	1,235	514.5	408.2	812.8	18.7

10,000 POUNDS IN HEAP IN OPEN YARD.

	Weight.	Water.	Organic Matter.	Mineral Matter.	Nitrogen.
November 3	10,000	661.7	282.4	559.0	64.3
April 30	7,138	470.7	167.8	753.0	63.9
August 23	7,025	530.4	106.4	657.0	46.3
November 15	6,954	695.4	947.0	840.0	46.0

1,652 POUNDS SPREAD IN YARD.

	Weight.	Water.	Organic Matter.	Mineral Matter.	Nitrogen.
November 3	1,652	109.3	559.0	92.3	9.45
April 30	1,429	114.3	285.5	105.1	7.70
August 23	1,012	709.3	312.7	190.9	4.14
November 15	950	622.8	327.2	228.0	3.88

These figures are found in Harris on Manures, taken from Prof. Voelker's report to the English Society alluded to, where they may be found in full. I have also seen them in full elsewhere in a special work.

These facts can have no force added to them by remarks. They show that fifty-nine per cent. of the nitrogen, worth about as much as all else left in the manure, including the nitrogen left, has leaked out of the manure exposed. Spread in the yard the table seems to show more mineral life than at the start. This is due to blowing winds and to dirt shoveled from the bottom of the yard, as the manure was taken up. There would be a very heavy loss of potash and other minerals shown if the test had been made for them.

The manure under cover seems to have lost weight, but this loss was in water and carbon, matters of no value practically, except an indirect value for the carbon, as plants get it easily from the air. The nitrogen was nearly all left, and the nitrogen is worth a considerable more than the other materials. If manure is the measure of our crops, then this loss from exposed manure will cut down most seriously our standard of yield. In short, it teaches us that protection to it is indispensible, and that neglect in this direction is not to be considered in good husbandry.

LIQUID MANURE.

Dana, in his "Muck Manual," gives the weight of liquid manure made from cows yearly, taken from actual tests, and finds from 800 pounds to 1,200 pounds of liquid, and from 1,400 pounds to 20,000 pounds of solid manure. Dr. Nichols analyzed the liquid manure of cows and found in a ton:

	In solids.	In liquids.
Nitrogen	5.11 per cent.	17.5 per cent.
Phosphoric acid	3.55 per cent.	10.12 per cent.
Potash	2.00 per cent.	15.9 per cent.

Taking Dana's smallest numbers for yield of manure, and multiplying by above figures we have a total product for the year of:

	In solids.	In liquids.
Nitrogen	35.71 pounds.	70.00 pounds.
Phosphoric acid	24.85 pounds.	40.48 pounds.
Potash	14.00 pounds.	16.60 pounds.

Liquid manure contains the materials that have already been solved in the system and passed off in a state of solution in the urine, and is consequently one of the most active manures, while solid manure is the materials that remain undigested in the system. By using the value of chemicals before named, and the value of those same chemical materials in solid manure, we get the following table as yearly value of cow manure:

	In solids.	In liquids.
Nitrogen	At 15 cents, $5.55	At 18 cents, $12.60
Potash	At 8½ cents, .49	At 4 cents, 2.54
Phosphoric acid	At 7½ cents, 1.86	At 9 cents, 3.63
Total	$7.70	$21.77

Total value of solid and liquid manure, $29.44. These figures will seem preposterous to us in Missouri, and are for manure here, but they are cold facts and serve to show us to what end a worn out soil tends. The cows in question were estimated as kept up for the entire year, and, of course, were grain fed. Of course I do not believe that we get this value out of manure, but that we had better use it. The liquid has not the same value for all animals.

A few points are to be noted: First, that the liquid is worth more than the solid; second, that under our system almost none of it is saved for our field lands from our foods. What magnificent crops our fields would give if we saved all of the solid and liquid manure.

The small amount of potash in the liquid manure shows that the loss of liquid manure leaves the solid manure a one-sided fertilizer, being deficient in this material.

We have a mass of facts touching the value of liquid manure, and the value from each class of animals, and its value in practice, but I only use those given to fix the necessity of preservation of this and solid manure.

HOW PRESERVE.

As we have practically no barns in Missouri, I will omit various expedients that are resorted to in connection with old barns that were not designed in their making for preserving manure, and name two substantial methods of saving both solid and liquid manure. The first is by cellars beneath barn stables whose floor, the cellar, is made water-tight by various processes. This includes drainage of the cellar and spouts to the eves to carry away water that might flood the cellar and leach the manure or injure the floor of the cellar. The water-tight vault need not cover only the section of cellar beneath the stalls and be large enough to hold the manure for the winter or for part of the winter. To accomplish this purpose, the bottom of the vault will be water-tight and the sides built up one and one-half to two feet. The liquid will not fill it as the solid manure will absort this liquid gradually as its own water is evaporated.

The bottom of the cellar may be cemented, as is customary to do water-tight vaults, with sand, gravel and cement.

On level grounds, or prairies, the system now advocated by those who object to a manure vault under the cattle on the score of health, will work admirably. A small building, as an annex, is added to the barn, entirely devoted to manure. It is dry a few feet below ground and made water-tight, and a track runs from this behind the stalls of all of the cattle. From a water tight floor the manure is daily run off on a tilting box, set on four wheels, to the vault where it is easily dumped. This system keeps the odors from the barn and is quite as cheap or cheaper than a cellar. I prefer a well ventilated and lighted cellar under a floor so well laid as to prevent the contaminated air from rising save by the ventilators. This saves labor, as the manure goes by gravitation through scuttle or trap doors very easily.

Whichever method we use we shall find it well to keep the cattle on raised platforms behind which a depression four inches deep and eighteen inches wide receives and holds the daily droppings. From such stables many prefer to draw the manure daily to the field.

All this involves barns and capital. Barns and capital are indispensible to successful farming of the best type, and like other industries, we have got to use the conditions of success.

APPLICATION OF MANURE.

There has been more controversy over the application than over the preservation of manure. Get it and apply it as we will, only get it. Modern researches have shown that certain strong claims of the past and present are not so important as supposed. *Plow in at once*, was a fixed law of not long ago, and is the law with some now. Voelker's trials did not show much escape of ammonia into the air, but great losses by leaching. If the manure is spread evenly it will wash into the soil. Thus spread, it will not lose so much in the air as was formerly supposed. Voelker found that fresh manure contained little free ammonia, (ammonia contains the nitrogen), that free ammonia was generated by heating or decomposition, but that as this decomposition progressed, plaster or sulphate of lime and certain organic acids were formed that fixed the ammonia. Thus, Nature provides for the saving of that which she most needs for crops. In heaps, when it ferments, it loses but little of nitrogen unless heating progresses too rapidly, or when the due proportion of moisture is exhausted when ammonia escapes rapidly. Horse manure, containing little moisture and loose or open to air, undergoes rapid decay and great loss of ammonia or nitrogen. To obviate this, water may be sprayed over it, or better still, have the horse manure either thrown in with other manure or with pigs who tramp it down and prevent too free access of air. As spread upon the surface of the ground, rains will wash manure into the ground, or if dry it will not undergo much decomposition and hence little loss of nitrogen.

These facts show, and experience fully corroborates them, that the great loss of manure exposed to the air by volatilization, heretofore claimed, does not occur. Yet, after more than an ordinary amount of practical experience in the use of manure and some years of experiments with it, I favor the incorporation of manure with the soil as soon as convenient.

First, because the manure in drouth is dried up on the surface and subject to a little blowing of winds, and does meet with a little loss of ammonia by escape into the air. Second, its fermentation in the soil aids the decomposition of the soil, and, as Renhallows has shown, effects its warmth slightly. Third, if a very rainy time comes on we know water runs from the surface of our peculiar soils very rapidly, flooding our creeks suddenly. The loss from the soil by this means is not nearly as great as would be expected, as soils have a peculiar power, easily shown, of retaining the leachings that water has brought upon it, even though it be running over its surface slowly. Yet a material loss occurs. I have known manure spread in the winter on frozen ground to give wonderful results, although rains and thaws of snow were shed from its surface.

Many advocate this method of using manure, as winter is a time of leisure and soft lands are then accessible. From even level lands I have seen colored water run from newly manured frozen lands, and commend the practice only as special circumstances seem to warrant. Fourth, manure on the surface tends to give an unnatural surface developments of the roots of plants, because phosphoric acid especially, and potash work very slowly into the soil, being fixed at once on contact with the surface.

Manure should never be left in the little heaps in the field so often indulged in. Rains will carry this matter largely into the soil under the heap, will take its most soluble materials and leave the ground, over which the manure is afterwards spread, covered with a poor manure, short of potash and short of crops as a consequence of its previous leaching.

The point of the location of the heaps will bear a four-fold crop and show for years, and be a standing advertisement of a sloven farmer. For the same reason the heaps must be spread even and well taken up at the bottom. Not one farmer in a dozen does this work for his own interest.

We have prolonged this article beyond intention, and we will not enter upon many questions connected with the application and practical methods of using manure. I will briefly say upon the question of plowing in versus applying upon the surface, that progressive farmers have been strongly favoring applying upon the surface of plowed ground, and tilling it thoroughly into the surface. The reasons are apparently sound. The roots are mainly in the surface; the manure will leach down fast enough, and the soil will hold the manure from evaporation.

The kind of soil must determine the method. My early views and methods favored mingling the manure with the surface, but they have undergone some changes for the following reasons, namely:

In our dry summers the upward flow of water by capillarity, when the soil is decomposing fastest, is often greater than the downward flow, as hygrometers have shown, and hence nitrogen may be carried to the soil and volatilized with water. My second reason for change is the more powerful reason, that of tests practically. As the following facts of the tests named are the only ones known to me, and as the soil here is peculiarly subject to loss from surface washings, and more subject to drouth than those of New Hampshire, where the trials were made, I quote from a bulletin that I there issued several years ago, several trials, believing them quite applicable to our conditions:

"Two years ago I gave the results of different methods of applying manures, and also of the effect of fermenting manures. Those trials have been continued, the reports of which I now renew. Lot 1 had eight cords of good manure spread on top and harrowed in; lot 2 had eight similar cords plowed under seven inches; neither lot has been plowed since the first application in 1877. Crop per acre, 1880: 4,261 pounds dried hay for lot 1; 3,936 pounds dried hay for lot 2. Crop per acre, 1881: 2,659 pounds dried hay for lot 1; 3,202 pounds of dried hay for lot 2.

Of the five crops taken, only four have been weighed. The first year to grass was uneven by winter-killing, and was therefore omitted. The amount taken in four crops is for lot 1, 19,849 pounds, or per year, 4,962 pounds per acre; for lot 2, 20,393 pounds, or per year, 5,098. Contrary to my early expectations, and prevailing theories of farmers and scientists, the manure plowed under has given slightly more, practically the same result as the surface-applied, the fifth crop being decidedly in favor of the manure plowed under, It is to be noticed that the manure was never plowed up, as is usual, that the land is heavy clay or clayey, and that some years the manure surface applied did better than when plowed under. Whether the latter difference is due to the character of the seasons will be a matter for future consideration. A fault of the experiment is that the manure was not weighed, as it was not at the time the experiment was started, practicable. The amounts were as nearly alike as I could judge them. The above plots covered thirty-five square rods each. The following were started in 1879 and had eight rods each, or one-twentieth of an acre; 1,760 pounds of sheep manure were applied to each. As the ground had been previously plowed, the manure was not completely covered as with the other lot. It has not been replowed.

Crop in 1880: Lot 1, manure surface applied, 5,320 pounds per acre; lot 2, manure plowed under, 4,880 pounds per acre.

Yield in 1881: Lot 1, manure surface applied, 6,000 pounds per acre; lot 2, manure plowed under, 6,500 pounds per acre. Lot 1, second crop, 1,400 pounds per acre; lot 2, second crop, 1,800 pounds per acre.

The above crop is hay. The average yield for three years is in favor of plowing under.

In 1879, another set was started for continuous corn growth, the ground being yearly plowed, and having a yearly application of manure. This gives the condition of plowing down and up again as under ordinary farm management. The manure to these plots has been weighed, not less in either year than ten tons per acre being used.

Crop per acre in 1880: Lot 1, 38.4 bushels of 80 pounds per bushel lot 2, 30.5 bushels of 80 pounds per bushel.

For lot 1, the manure was plowed under; for lot 2, spread and harrowed under. The stover was weighed, but the amount for lot 2 lost. Our crop of corn for the thirty plots and in general field culture was the most unsatisfactory for that year of any we have taken, although a good corn year for other farmers. I place less reliance on these results than usual, but do not think proper to omit them in the series.

Crop in 1881: Lot 1, corn of 80 pounds per bushel, 53 bushels; lot 2, corn of 80 pounds per bushel, 55.9 bushels. Lot 1, stover dried, 6,200 pounds; lot 2, stover dried, 5,700

The result, both for oats and corn with a single exception (and this in proportion of seed to stalk probably no exception), shows that plowing under manure gives less seed and more straw or stalk than surface application per acre. Will any one give a sound reason for this? I can give one that looks sound, why it should be the other way. The more I weigh (scale weighing) the more I appreciate the uncertainties of theorizing, and the need agriculture has of extensive experimental inquiries to furnish the facts upon which to found farm laws. I may also add that the mere observations of farmers—and I willingly include myself in the list—afford an exceedingly uncertain basis.

FERMENTED MANURES.

I have reported for the first year's trials, or for 1879, but will repeat that the course of results may be seen. Plots, one-twentieth of an acre; manure used, one thousand pounds after the first year, taken from behind the same cattle alternate days when they had same foods, hence the manure is identical.

Plot 1, raw manure, 1,600 pounds. Yield in 1879, 11,000 pounds of stover and 8,320 pounds corn.

Plot 2, manure fermented down to 1,350 pounds. Yield in 1879, 8,200 pounds of stover and 6,480 pounds of corn.

Plot 1, yield in 1880: stover, 3,940 pounds; corn, 3,306 pounds.
Plot 2, yield in 1880: stover, 4,240 pounds; corn, 3,560 pounds.
Plot 1, yield in 1881: stover, 3,800 pounds; corn, 4,040 pounds.
Plot 2, yield in 1881: stover, 5,600 pounds; corn, 5,260 pounds.
Average of plot 1: stover, 6,247 pounds; corn, 5,240 pounds.
Average of plot 2: stover, 6,013 pounds; corn, 5,100 pounds.
Amount of fermented manure lost in 1880, 200 pounds.
Amount of fermented manure lost in 1881, 100 pounds.

The manure was not fermented as thoroughly as I like to have it. I found that in green manure under cover it was difficult, in so small a lot, to get ready fermentation."

I have added the tests of fermented manure as it accompanied the original paper and is of some interest in this connection. The facts of the trials explain themselves.

In conclusion, allow me to express my profound interest in higher agriculture in our State, and belief in its superior possibilities. Few States can equal ours in these possibilities. In the interest of a better agriculture, I have spoken freely of the errors of our present type, nor have I spoken hastily, nor without experience.

For a few years your College Farm in my charge has been carried on for future results as well as for immediate results, blending the two purposes. At present a clear and distinct advance in its crop yield is manifest, and so far an advance as to materially affect its annual income with a greater prospective increase in the near future. Nor has it been done at the expense of the State. The State has been a positive expense to the farm. The use of manures and rotations with good tillage has allowed the farm to more than meet expenses while increasing its fertility.

These personal remarks will be pardoned by the generous reader, for he well knows that we write against a public prejudice against scientific data from certain quarters. I have rather written from the standpoint of experience and with a desire to see our crops more than double in the next decade, and in good hands multiply by them over the State's average, as may be done and bring prosperity.

THE GRASSES OF MISSOURI.

BY B. T. GALLOWAY.

There are two great departments in nature: First, the inorganic and second the organic world. The air, the rocks and all things destitute of life make up the inorganic world. The organic world consists of plants and animals. Plants make up the vegetable kingdom, animals the animal kingdom.

The vegetable kingdom is divided into two great divisions, namely: First, the series of flowering plants. These have true flowers and produce true seed; as the rose, apple, the grasses, etc.

Second, the series of flowerless plants. These do not have true flowers or seeds. The ferns, mosses, mushrooms, etc., belong to this last named series. Flowering and flowerless plants are again divided into classes, orders, genera and species.

The number of known species of flowering plants amounts to about 100,000. As stated above, they are grouped into classes, orders, genera, etc.

The grass family (*order Gramineæ*) contains about 4,500 species. They are found in all parts of the world, in the tropics many of them are large and tree like; in the north they grow mostly in bunches. Here in the temperate zone they clothe the earth with a soft green carpet. In the whole world the order ranks third in size; the order *Compositæ* (sunflower family), with 10,000 species, is the largest. But despite the great size of this order, only a few of these plants are of any use to man. The order *Leguminosae* (pulse family) contains about 6,500 species, ranking second in size. Clover (*Trifolium pratense*), Lucern (*Medicago sativa*) and many other valuable plants belong to this order. The number of known grasses (species and varieties) in the United States is variously estimated at from 500 to 600.

Gray, in his manual of Botany, describes something over 200 species found east of the Mississippi river; about 130 of these are found in Missouri.

To most farmers grass is grass, and that is all they care about it. Very few know the importance of this one order of plants. It is claimed by some that cotton is king; but the following figures will show what kind of a king it is. The value of the cotton crop of the United States for 1882 was $309,696,500. The value of the hay crop of the United States for 1882 was $369,958,158; about one-sixth more than the cotton crop.

$369,958,158 is the value of the hay crop alone; if we add to this amount the value of corn, wheat, rye, oats and barley we have a grand total of $1,830,812,689. One seventh of the railroads in the United States could be bought with this sum.

In 1882 Missouri produced 1,066,683 tons of hay, valued at $9,079,606, the average yield per acre was 1.12 tons, value per ton, $7,60. To find the value of our pastures is somewhat difficult; but they are at least equal to that of the meadows. Assuming that the value of pastures and meadows are equal, then the value of the annual productions of the pastures and hay crop of the State amounts to about $18,159,212.

Grasses furnish us with bread, and bread is the staff of life; they furnish us with sugars and syrups, and last but not least, they furnish the materials from which is manufactured some of the drinks that cause so much trouble in this world. But for corn, oats and hay what would our domestic animals do? In short, all flesh is grass, and grass is king. It is the clothes on our back, the shoes on our feet, and surely it is worthy the name of king.

HOW TO DISTINGUISH GRASSES FROM OTHER PLANTS.

Grasses may be known from other plants by their jointed stems, commonly, but not always, hollow; and by their two ranked leaves. If we examine any grass corn or wheat, for instance, we will find that the second leaf stands on the opposite side of the stem from the first, and the third on the opposite side from the second; then all the leaves are in two ranks: one on one side of the stem, and one on the other.

Sedges are about the only plants we would mistake for grasses, but in sedges the leaves are three ranked. In this arrangement the second leaf is placed one third of the way round the stem, and the third leaf two thirds the way round. The stems are never hollow, and are usually three angled. Clover is usually spoken of as a grass, and its chemical composition is very much like the chemical composition of some grasses. But botanically there is as much difference between clover and grass as there is between a corn plant and a bean plant.

The seed of clover is divided into halves, as with the bean, pea, etc., and the young plant has two seed leaves, or is *Dicotyledonous.* The seed of grasses are not divided in halves, and the young plant has only one seed leaf, or is *Monocotyledonous.*

CHEMICAL ANALYSIS OF GRASSES.

It is strange that such a small number of the grasses are cultivated. We have about 130 species growing here in our midst, and very little is known of their nutritive value. True, many of our native grasses have very little value, and about the only way we have of learning their value is by chemical analysis. Chemical analysis alone will not tell us the value of a grass. For instance, analysis may show that a grass is very rich in nutrative matter, yet the leaves of the grass may be covered with bristles; or the grass may be tough and wirery. In either case the animal would not eat it, and of course the grass would have little value. Yet analysis is valuable for comparison, we can compare the analysis of some of our well-known grasses (timothy for instance) with the analysis of some of our native grasses, and thus get at their probable value in that way.

In order that the reader may be able to understand the analyses that will be given, a few words upon the nutritive matter found in grasses and other plants, will not be out of place.

The valuable constituents of a grass, or any forage plant, may be divided into four groups, namely:

First, Albuminoids.—From these the flesh of an animal is formed; by flesh we mean the muscles, tendons and all the lean meat. They are the most important elements of any food, and the more albuminoids there are present the greater the value of the food.

Second, Carbhydrates.—The chief substances composing this group are: starch, gum, sugar and woody fibre. The carbhydrates are the heat producing principles, and according to some, the oxidation of carbhydrates furnishes some of the muscular force exerted by the body. The carbhydrates are usually separated into *crude fibre*, and nitrogen free extract, and we usually find an analysis reading that way.

Third, Fats.—These aid in the digestion of the albuminoids, and are also a source of fat to the animal. Fat is found in most all plants, the seeds of cotton, flax and castor beans contain a large quantity of oil or fat, and the oil of each forms an article of commerce.

Fourth, Ash.—The ash or mineral substances found in plants are absolutely essential to animal growth. Animals can live only for a short time on food free from inorganic or mineral matter. But plants usually contain all that an animal requires, and no special consideration of the quantity is necessary.

NUTRITIVE RATIO.

The nutritive ratio, which is usually given along with the composition of a grass, is the ratio between the fats and carbhydrates, and the albuminoids. Many experiments show, that in order to obtain the best results from a food, the ratio of carbhydrates and fats to albunoids, should be in the proportion of about five to one. If the ratio is wider than the above, some of the nutrients will not be utilized. It is economy then to have the ratio as near five to one as possible. By a combination of foods we can easily produce this result, but this is a wide field, and at present we have not the time to discuss this matter of food combination.

CALCULATION OF FODDER VALUES.

"The average value of hay since 1870 has been $12.86 per ton; and this, taken in conjunction with the average composition of American grasses analyzed by us gives the following:

Values of the available nutrients of American hay:

Albuminoids	3.4 cents per lb.
Fats	2.93 " "
Nitrogen, free extract	0.72 " "

Two or more grasses varying in composition may have the same values. This means that all are worth the same as fodder if used so as to economize all the nutrients. A clover hay whose composition might be:

Moisture		16.7 per ct.
Fat	Carbhydrates	3.2 "
Nitrogen, free extract		32.9 "
Crude fibre		29.9 "
Albuminoids		11.0 "
Ash		6.3 "

Nutritive ratio 1 to 3.28, is worth, according to the values given above, $14.10 per ton; that is to say, it contains nutritive ingredients of that value. If used in combination with other foods, poor in nitrogen but rich in carbhydrates, the nutritive ratio will be made normal and the full value of the clover would be realized.

The ratio of fats and carbhydrates to the albuminoids being 1 to 3.28, about 35 per cent. of the nitrogen would thus be fed at a waste by feeding the hay alone; and therefore, while this hay, properly fed, would have a nutritive value of $14.10 per ton, only $11.50 would be economically fed, while the remaining $2.60 worth of material would simply serve the purpose of an equivalent amount of carbonaceous food at a much less market value." Dep't. Ag. Report, 1878.

Suppose now that we have the analysis of a grass having the following composition:

Albuminoids	**9.92**	**per ct.**
Crude fibre	**23.94**	"
N., free extract	**44.96**	"
Fat	**2.45**	"

To calculate the value of the nutrients, we multiply:

9.92 by 3.4 equals	**Value of Albuminoids.**
23.94 **44.96** } by .72 equals	" **Carbhydrates.**
2.45 by 2.93 equals	" **Fats.**

The sum of the products obtained will give us the value of the nutrients found in 100 pounds of the grass; this amount multiplied by 20 will give the value of nutrients found in one ton. This gives the value of the total amount of the nutrients present; but no animal can digest all of the nutrients; and of course only those nutrients that are assimilated are of value to the animal.

The result of all available experiments show that the following proportions of the different nutrients are digestible:

Albuminoids	**56**	**per ct.**
Crude fibre	**57**	"
Nitrogen, free extract	**63**	"
Fat	**48**	"

The above figures were obtained by practical experiments and are about the average amounts digestible.

To calculate the amount of digestible material in a fodder, we multiply the amount of each nutrient contained in the fodder by the corresponding digestion coefficient.

The following calculation will explain:

A FODDER CONTAINS

Of Albuminoids, 9.92 per cent times .56, equal.......	**Digestible Albuminoids.**
Of Crude fibre, 28.94 per cent times .57, equal........	**" Crude fibre.**
Of N. free extract, 44.96 per cent times .63, equal.....	**" N. free extract.**
Of Fat, 2.45 per cent times .48, equal................	**" Fat.**

We hope now, enough has been said to enable the reader to understand the analyses that will follow. We will next discuss the grasses, and heading the list of our most valuable grasses is:

PHLEUM.

The name Phleum is an ancient Greek name, supposed to have been applied to typha (cats-tail).

Phleum Pratense (Timothy, Herd's Grass).—This grass is a native of America. It was discovered by a Mr. Herd, who cultivated it and called it Herd's grass. About ten years after its discovery, it was introduced into Maryland by Timothy Hanson. Its fame spread rapidly, and it was called timothy by the farmers who cultivated it at that time. It was introduced into England about the year 1770, and was cultivated about sixty years, attracting very little attention till 1824, when Sinclair's experiments were made.

As a hay grass, it has no equal, being easily handled and the best grass we have for marketing.

Timothy is a perennial, and on dry soil the roots are inclined to be tuberous. It bears grazing poorly, as the tubers are easily injured by cattle treading on them. Subjoined is:

WAYS' ANALYSIS.

	Dry.	
Albuminoids	11.36	per cent.
Fat	3.55	"
Heat producing principle	53.35	"
Woody fibre	26.46	"
Ash	5.28	"
Nutritive Ratio, 1:9.4.	100.00	

The roots of timothy do not penetrate the soil to any great depth, and they exhaust the surface soil very rapidly. If grown in good soil and manured, timothy will yield three to four tons per acre. The average yield in Missouri is about one and one half tons per acre.

Sow at the rate of about twelve pounds per acre, if alone, but less if mixed with other grasses.

DACTYLIS.

Dactylis Glomerata (Orchard Grass).—This grass is indigenous to the soil of America, and is one of our most valuable grasses. The leaves are broadly linear, bluish green, spikelets several flowered, crowded in one-sided clusters, stems three to four feet high, flowering in this State about the first week in June. It is not cultivated to any great extent in this section of the country, but it is attracting attention, and we hope it will soon be used more extensively.

Mr. Gould, of New York, says: "The testimony that has been collected from all parts of the world for centuries past, establishes the place of this species among the very best of our forage grasses, and we have not the shadow of a doubt that the interests of our dairymen and graziers would be greatly promoted by its more extended cultivation."

It is always found in the rich old pastures of England where an acre of ground can be relied on to fatten a bullock and four sheep. Orchard grass has a tendency to grow in clumps; but this can be obviated by growing red clover with it, and by close cropping. If mixed with clover, it should be sown at the rate of one bushel per acre; if alone, two bushels per acre.

ANALYSIS (U. S. Dep't. Ag. Report).

Albuminoids	7.28 per cent.
Crude fibre	21.35 "
Nitrogen, free extract	46.92 "
Fat	2.99 "
Nutritive Ratio, 1:7.	

WAYS' ANALYSIS.

Albuminoids	13.33 per cent.
Fatty matter	3.14 "
Carbhydrates	44.32 "
Woody fibre	33.70 "
Ash	5.31 "

The two analyses are somewhat different, but the composition of any grass will vary when grown under different conditions and cut at different stages of growth.

Prof. Phares, of Mississippi, says: "Sheep leave all other grasses if they can find this; and acre for acre, it will sustain twice as many sheep or other stock as timothy or other esteemed pasture grasses."

We have no doubt orchard grass is more valuable for pastures than is timothy; but timothy is not one of our esteemed pasture grasses, although our best hay grass, and it will be a long time before it is put aside for any other.

ALOPECURUS.

Alopecurus Pratensis (Meadow Foxtail).—This grass is a native of Europe, but has been introduced and is common in the meadows and pastures of New England and New York.

It resembles timothy, but the spike is shorter than the spike of timothy, the stems are upright and smooth. The leaves are three to four inches long and about one-fourth inch wide. It is a perennial, and one of the first grasses to start in spring. It grows best on a rich moist soil, and flowers in May about two weeks earlier than timothy.

WAYS' ANALYSIS.

	Dry.
Albuminoids	13.32 per cent.
Fat	2.92 "
Heat producing principles	43.12 "
Woody Fibre	33.83 "
Ash	7.81 "
Nutritive ratio 1:6.8	

AGROSTIS (Bent Grass).

Five species of Agrostis are common in this State.

Agrostis vulgaris (Red Top).—The spikelets of this grass are one flowered; the stems are one to three feet high, upright, or sometimes decumbent at the base; the leaves are narrow and from four to eight inches long. This is a valuable grass for low wet meadows. On such soil it flourishes, and produces a good hay. It is often sown with timothy or red clover. When sown alone, two bushels of seed per acre is required.

ANALYSIS.

Albuminoids	11.88 per cent.
Fiber	20.20 "
Nitrogen free extract	50.84 "
Fat	3.85 "
Nutritive ratio 1: 6.7	

Agrostis alba (White Bent Grass).—Resembles the last; but the panicle is greenish white or barely tinged with purple. The stems are one to three feet high, sometimes rooting at the lower joints. It is occasionally found growing in damp shady places; it flowers in June and is valuable, like the last, but we have not heard of its being cultivated anywhere in the State.

Aqrostis perennans (Thin Grass).—The culms are weak and slender, one to two feet high; the leaves are four to six inches long, but very narrow; flowers in August; found in damp shady woods; no agricultural value.

Agrostis scabra (Hair Grass, Tickle Grass).—A delicate grass very common on rocky hillsides; the culms are one to two feet high; the leaves are short and very narrow; the purple panicles are large and very loose, and when old they break off and are tumbled about by the wind. It is a perennial and flowers in June.

Agrostis elata is found growing with the others; but it is of no agricultural value.

POA (Spear Grass).

The members of this genus are all more or less valuable; and one of them (*Poa pratensis*) is our well known blue grass. Gray, in his Manual of Botany, describes twelve species that occur in the United States east of the Mississippi river, nine of which I have found within the borders of our own State.

The members of this genus have two to ten flowered spikelets, the rhachis or axis between the flowers, hairy. The glumes are mostly shorter than the flowers, and one to three nerved; the flowering glumes are membranaceous (thin like a membrane), and five nerved, the principal nerves commonly clothed at the base with long hairs, or long and crisped cob-web like wool. The culms usually grow in tufts.

Poa pratensis (Kentucky Blue Grass).—This grass is so well known that it needs no lengthy description. Many authors declare that this grass is a native of America; others claim that the seed was brought from England and planted first in Virginia, and that from Virginia the seed was carried to Kentucky. It spread rapidly and even, became troublesome. These, and many other theories, have been advanced as to its origin; but we have no reliable information on the subject.

It flourishes on rich limestone soil; and this is one of the reasons why it is so valuable in the famous blue grass region of Kentucky. It is well known in England; and has been cultivated there for more than a century.

WAYS' ANALYSIS.

Albuminoids	10.35 per cent.
Fat	2.63 "
Carbhydrate	43.06 "
Woody Fiber	38.02 "
Ash	5.94 "

COMPARISON WITH OTHER GRASSES.

	Orchard Grass....	Timothy.......	Ray Grass........	Meadow Foxtail..	Blue Grass........
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Albuminoids..................	11.53	11.36	11.85	13.32	10.35
Fat............................	3.14	3.55	3.17	2.92	2.63
Carbhydrates..................	44.42	53.35	42.24	43.12	43.05
Woody Fiber...................	33.70	26.45	32.20	33.83	38.02
Ash............................	5.31	5.28	7.54	7.81	5.94

The value of the nutrients present in one ton of each is as follows:

Blue Grass..	$14.90
Timothy..	15.10
Orchard Grass..	15.40
Ray Grass..	15.35
Meadow Foxtail..	17.85

From the above figures we see that pound for pound, blue grass is worth less than any of the above named grasses; and yet blue grass is our most valuable pasture grass, because our limestone soil is its home, and on such a soil it will grow and flourish, and furnish more nutritive matter per acre than any other pasture grass.

It is more nutritious when young, as the following figures will show:

Analysis of *Poa pratensis* at different stages of growth.

	Albuminoids......	Crude Fiber......	N. Free Extract..	Fat..............	When cut................
	Per cent.	Per cent.	Per cent.	Per cent.	
Panicle just visible...........	19.88	18.43	48.75	4.88	April 23.
Panicle spreading............	16.21	22.83	51.32	4.07	May 1.
Full bloom....................	12.61	23.76	51.43	3.90	May 21.
In seed........................	12.49	24.34	52.54	4.25	June 8.

From the above figures we see that as the grass grows older the albuminoids decrease and the carbhydrates increase. We will find this to be the case with most of our cultivated grasses; but we will speak of this farther on. .

As a hay grass, *Poa pratensis* is not so valuable as some others. Sinclair found that 10,209 pounds of green blue grass weighed, when dry, 2,871 pounds; and contained 279 pounds of nutritive matter; 40,837 pounds of green timothy weighed, when dry, 19,397 pounds, and contained 3,669 pounds of nutritive matter; 26,544 pounds of green orchard grass weighed, when dry, 13,372 pounds, and contained 1,451 pounds of nutritive matter. Thus we see that blue grass makes a very light hay; and when dry it contains a much smaller quantity of nutritive matter than either timothy or orchard grass.

Mr. Lear, one of Marion county's best farmers, says: "My own experience and observation is that farmers do not generally appreciate blue grass pastures; from the fact that many of the oldest and most independent farmers never owned a blue grass pasture, in its true meaning. They very rarely sow in land that has been cleared up or plowed; and none of them sow seeds enough to make a crop without waiting sometimes for years for it to take."

The rule is to sow in the woods, or I might say the rule is not to sow the seed at all; from the fact that all over the State it is spreading over the commons. Along the roadsides and cow paths you can find it, stealing its way among the brush and timbers, showing clearly what it would do if it had a chance.

Poa compressa (Blue Grass, Wire Gras).—This grass is quite common in the northern part of the State, and is often mistaken for *Poa pratensis*, but it differs from it in having the culms much flattened and ascending obliquely from a creeping base; the leaves are short and bluish green. The panicle is dense and contracted, partly one-sided; the branches of the panicle are commonly in pairs ; the spikelets are four to nine flowered, flat.

The flowers are linear, elliptical and rather obtuse. It is usually found growing along roadsides and in dry, sandy fields; flowers in May.

ANALYSIS (Collier.)

Albuminoids	7.56 per cent.
Crude fiber	21.75 "
Nitrogen, free extract	49.00 "
Fat	2.95 "
Ash	4.96 "
Nutritive ratio, 1: 6.9	

Cattle eat this grass, and seem very fond of it. It grows in bunches and forms a strong turf.

Poa serotina (Fowl Meadow Grass).—This grass is one of the best we have for moist, wet lands. The culms are two to three feet high, not rooting at the base; leaves long and narrow; spikelets three to four flowered; green, or often tinged with purple. It resembles red top in some respects, and hence the name false red top.

Prof. Phares says: " In the eastern States it has been cultivated for 150 years, or longer, and valued highly. Jared Elliot, in 1779, spoke of it as growing tall and thick, making a more soft and pliable hay than timothy, and better adapted for pressing and shipping for use of horses on shipboard."

.He says it makes a thick, abundant growth on land more moist than is adapted to the common upland grasses, and may be mowed any time from July to October.

ANALYSIS (Collier).

Albuminoids	8.91 per cent.
Crude fiber	17.87 "
Nitrogen free extract	56.40 "
Fat	2.43 "
Ash	3.63 "
Nutritive ratio.................1: 10.9	

Poa brevifolia (Short Leaved Spear Grass).—Culms one to two feet high, two to three leaved, the upper leaves short; spikelets three to five flowered; found growing in woods and shady places; no agricultural value.

Poa flexuosa has the leaves longer than in the last; the panicle is very effuse, its branches two to four inches long; found growing with the last.

Poa alsodes has the leaves very narrow, the uppermost two and a half to four inches long; the branches of the panicles are usually in threes—flowers in June.

Poa sylvestris.—Culms flat, erect; branches of the oblong pyramidal panicle short, in fives or more; found growing in rocky woods—flowers in June.

Poa nemoralis (Wood Meadow Grass).—This is a perennial grass, and in moist, shady situations it will produce a good crop of hay. It is nutritious, and cattle are very fond of it. It grows from one to two feet high, and has an erect, slender stem—flowers in July.

Poa annua (Low Spear Grass).—This small, delicate grass is a native of Europe, but has become naturalized, and is now one of our most common grasses. The culms are three to eight inches high, flowering the first of May, and after flowering it dries up rapidly, and by the last of May it is dry enough to burn. If the season is favorable, it will flower again about the last of June, and then dry up as before. It is said that cattle are very fond of it; and it is claimed by some, that when cows eat this grass it improves the quality of the butter.

WAYS' ANALYSIS.

Albuminoids	11.83	per cent.
Fat	3.42	"
Heat producing principles	51.70	"
Woody fiber	30.22	"
Ash	2.83	"

Poa arachnifera (Texas Blue Grass).—This is a valuable grass for the south, and it is attracting attention in all the southern States.

Dr. Vasey says: "This species was first described by Dr. John Torrey, in the report of Capt. Maray's exploration of the Red river of Louisiana, as having been found on the head waters of the Trinity; and named *Poa arachnifera*, from the profuse webby hairs growing about the flowers."

FESTUCA (Fescue Grass).

The members of this genus have three to many flowered spikelets, and the flowers are not webby at the base. The glumes are unequal, mostly keeled; flowering glumes three to five nerved, acute, pointed or often bristle armed. Four species are found growing in Missouri.

Festuca tenella (Small Fescue).—This is an annual, and grows on dry, sterile soil; the spikelets are seven to nine flowered; leaves very slender; culms six to twelve inches high; of little value.

Festuca ovina (Sheep's Fescue).—Spikelets two to six flowered; leaves narrow; culms six to fifteen inches high; a perennial grass growing in dense tufts. This grass is rarely found in cultivation in this section of the country, but no doubt it would prove a valuable grass for growing on some of our rocky hills. We have never seen an analysis of this species, but the other fescues are rich in nutrition, and no doubt this one is also.

Gould says: "It forms the great bulk of the sheep pastures of the Highlands of Scotland, where it is the favorite food of the sheep, and where shepherds believe it to be more nutritious for their flocks than any other." *Var duriuscula* resembles the last, but it is taller and the panicle is more open—flowers in June.

Festuca elatior (Tall Fescue Grass, Meadow Fescue, Rendell Grass).—Spikelets five to ten flowered; culms one to four feet high; the leaves are about twelve inches long, and one-third of an inch wide.

ANALYSIS.

Albuminoids	12.10 per cent.
Starch, gum, sugar, etc	40.43 "
Woody fiber	38.71 "
Fat	3.34 "

It grows well on any kind of soil, and flowers in June; the roots are long and fibrous, and they penetrate the soil eight to ten inches. It is a valuable winter grass for the south, as it grows all winter. I have seen this grass four inches high in mid-winter, and it was as green as our blue grass in May.

Festuca nutans (Nodding Fescue).—The spikelets of this grass are three to nine, flowered; the branches of the panicle are long, and bearing near their extremity the flowers; when the seeds ripen they have weight enough to cause the branches of the panicle to droop, hence the name, nodding fescue. The culms are two to four feet high—flowers in July.

LOLIUM (Darnel).

Lolium perenne (Ray or Rye Grass).—This grass is a native of Europe, and was introduced into this country about a century ago. The English have praised it to the skies, but it has never been very popular in this country. It is a perennial; and the culms are two to three feet high; the spikelets are many flowered, and placed edgewise on the rhachis. It succeeds best on moist land, and is largely used for lawns in conjunction with other grasses. It should be sown at the rate of about one and a half bushels per acre—flowers in June.

WAYS' ANALYSIS.

Albuminoids	11.85 per cent.
Fat	3.17 "
Heat producing principles	42.24 "
Woody Fiber	35.20 "
Ash	7.54 "

ANTHOXANTHUM.

Anthoxanthum odoratum (Sweet Vernal Grass).—This grass is a native of Europe. It is a perennial, and one of the earliest grasses in spring. The culms are slender and from eight to eighteen inches high; the spikelets are three-flowered, but the lateral flowers are neutral, and only the terminal flower is perfect. It is not considered a valuable grass for hay, as the culms are thin and have very little foliage. As a lawn-grass it is valuable, but it should never be sown alone. When in blossom it exhales a delightful fragrance.

WAYS' ANALYSIS.

Albuminoids	10.43 per cent
Fat	3.40 "
Carbhydrate	43.48 "
Woody fiber	36.36 "
Ash	6.32 "

We have now discussed most of our valuable cultivated grasses; true, we have many others that are valuable (and they will be discussed in their appropriate place); but these have been selected from the large number of grasses we have, as the most valuable to the farmer. It was our intention to discuss only the grasses proper; but as some of our most valuable forage plants belong to the order *Leguminosae*, we will mention a few plants of this order.

TRIFOLIUM (Clover).

The members of this genus are so well known that little can be said about them that will interest the reader.

Trifolium pratense (Red Clover).—This is by far the most important of all the clovers. It can be grown for hay and for pastures, and is very rich in nutritive matter, as the following analysis will show:

Albuminoids	16.01 per cent.
Carbhydrates	41.00 "
Crude Fiber	35.01 "
Ash	7.08 "

"The immense value of clover as a crop preparatory to other crops, especially wheat, is well known, and there is perhaps no way by which exhausted lands may be more readily restored to fertility and maintained in such condition than by the use of clover; certainly there is no method which compares with it in expense. Now, although clover requires an amount of plant-food, both mineral and atmospheric, far in excess of a wheat crop, nevertheless it is a fact very well established, that the former crop may be successfully grown upon a field where wheat would invariably fail of a crop.

The reasons for this are to be seen in a comparison of the two plants; and although it is a thrice told tale, the subject especially in connection with the plant under consideration is such that every farmer should practically understand the matter.

Clover and wheat then belong to two families of plants, which in nearly every respect are in the strongest contrast.

Clover is one of the *dicotyledons*, or those of which the seed is divided into halves. These plants are characterized also by a strong tap root which, descending into the subsoil, enables the plant to secure nourishment from beyond the reach of plants of the other sort.

Wheat, on the contrary, belongs to the *monocotyledonous* plants, the seed of which are not so divided in halves. The roots of this family of plants are surface or crown roots, and are destitute of the tap root already spoken of.

Again, if we consider the habits of growth of the two plants, we have in clover a plant of continuous growth throughout the season, until cut down by frost or the scythe of the mower, and an enormous leaf development, as compared with wheat, with its scant leafage and its short life.

We have, then, in clover a plant with a tap root and an enormous root development, enabling it to seek out and assimilate mineral food; with a great extent of leaf surface, fitting it to take in an assimilate atmospheric food; a long period of growth, which causes it to appropriate the greatest amount of both kinds of food and store them up in root and stem.

In wheat, on the other hand, we have a surface rooted plant, a scanty leafage, and a short period of growth. What wonder then that so coarse a feeder, as clover should thrive even when so dainty a plant as wheat would utterly fail, as is so often the case. But, as will be remembered, all this atmospheric and mineral food which has been assimilated and stored up in the roots and stems of clover remain to furnish an abundant supply by its decay to the crop which shall succeed it." (Ag. Report, 1878).

Trifolium repens (White Clover).—The value of this plant for pastures, and in conjuction with the grasses, is well known. It is a perennial, and the seed should be sown at the rate of about six pounds per acre. White clover is valuable for the large quantity of honey it yields, and it is often planted for that purpose.

Trifolium arvense (Rabbit foot clover).—The heads of this clover are cylindrical and very soft and silky ; it is an annual, and the stems are five to ten inches high.

Trifolium reflexum (Buffalo Clover).—This clover is a native of this country. The stems are ten to eighteen inches high, pubescent and very stout. The flowers are larger than in red clover, rose red or white.

Tripolium stoloniferum (Running Buffalo Clover).—Stems smooth with long runners from the base ; it is a perennial, and is found growing in damp woods. The flowers are white tinged with purple, as large as the last.

Trifolium hybridum (Alsike).—This clover yields a large amount of hay, and it is said to be superior to red clover in feeding value.

Prof. Phares says: "This Sweedish species is superior to red clover in feeding value; furnishes more fat and flesh forming principles, and less crude fiber; it is admirable for grazing. It is slow taking possession of land, but it is perennial, and does well with orchard grass, both for grazing and hay."

MEDICAGO (Medick).

Medicago sativa (Lucern, Alfalfa).—This plant is now grown extensively in California. It is a valuable plant for California and some of the southern States, but for our section of the country it is of no great importance.

Prof. Brewer, of California, says: "In cultivation it is probably the most valuable of forage plants for warm and dry regions. The root often reaches a depth of eight to ten feet, and may endure for many years; the herbage is very nutritious, and on deep soils, with proper moisture, it yields several crops."

In some sections it is sown in drills ten or twelve inches apart. This process requires about ten pounds of seed per acre. Others sow it broadcast at the rate of twenty five pounds per acre. If sown in drills it should be cultivated the first year, but if sown broadcast this is unnecessary.

ANALYSIS.

Albuminoids	16.27 per cent
Fat	2.36 "
Nitrogen free extract	37.30 "
Crude fiber	35.95 "
Ash	8.13 "

LESPEDEZA (Bush Clover).

Five species of *Lespedeza* are common in Missouri. They grow on poor soil and cattle will eat them when they can get nothing better.

L. procumbens is a trailing plant, covered with a soft down.

L repens is smooth, except some small scattered hairs; it is prostrate, and grows on dry, sandy soil.

L. violacea. (Purple Bush Clover.)—The stems of this plant are upright and much branched; the leaves are whitish, downy beneath, with close pressed pubescence; peduncles or clusters, few flowered.

L. stuvei. Stems upright, bushy, downy; common on dry, sandy soil.

L. capitata. Peduncles and petioles short; stems mostly simple. These plants are nutritious, and they may prove valuable on some of our poor, sandy soil; they belong to the order *Leguminosæ* (Pulse Family), along with most of our valuable forage plants.

DESMODIUM (Beggar Lice, Tick Seed).

The members of this genus are attracting attention in the South for their value as forage plants, and as we have several species that may prove valuable, we will give a brief outline of their characteristics, nutritive qualities, etc.

We are all familiar with these plants, as they are common. The seed-pods are roughened with minute, hooked hairs, by which they adhere to the clothing of passers by.

D. canescens. Stem loosely branched, four to five feet high; hairy; grows in moist ground—flowers in August. *D. Dillenii* and *D. Marilandicum* are common, and found growing on dry hills.

ANALYSIS (Collier).

	Desmodium.	Red Clover.
Albuminoids	21.22 per cent.	16.0 per cent.
Carbhydrates	45.83 "	41.0 "
Cellulose	25.39 "	35.0 "
Ash	7.56 "	7.8 "

From the above analysis we see that these plants are very rich in albuminoids. This analysis shows that *Desmodium* contains more than double the albuminoids contained in red clover.

IMPROVEMENT OF GRASS LANDS.

As a rule farmers give very little attention to the improvement of their grass lands; many of our western farmers never sow any seed at all, but wait and let nature take its course.

Mr. Gould, in his work on grasses gives under the heading of "What is requisite for the improvement of our grass lands," the following eight rules:

"First—That the special use of each species of grass should be accurately ascertained.

Second—That the absolute and comparative values of each species should be ascertained by chemical analysis, and by practical trials at the manger, to be tested by the scales.

Third—That the adaptation of each species to different soils, climates and circumstances should be tested by thorough and repeated trials.

Fourth—That the period of its growth when it contains the greatest amount of those properties on which its value chiefly depends, should be thoroughly investigated, until it is fully determined.

Fifth—We must learn the kind of culture and manures best adapted to stimulate its growth and to increase its valuable properties.

Sixth—We must determine the time of flowering of each species, and the period when its seeds are ripe.

Seventh—We want to know what kinds of insects prey upon each species, and the best method of preventing their ravages.

Eighth—The best and most economical means of curing and preserving them."

Some of these are difficult questions, but study and patience will enable anyone to master them.

PLANTING.

Preparation of the land.—The ground must be plowed and thoroughly pulverized, and the surface made as nearly level as possible. If the surface is finely comminuted, it will require less seed, and the young plants will make a better growth, as the young roots can obtain a better footing. Having the soil well prepared, the next step is the sowing of the seed. The time to sow will depend somewhat on the weather and the condition of the soil. Early in September, if the ground is moist and in good condition, we can sow, and the grass will get a good start before cold weather. Some prefer waiting until the weather is sufficiently cold to prevent germination; if we sow in this way we have the grass starting early in Spring.

After sowing the seed it should be lightly covered with a brush or harrow, and, if dry weather is likely to follow, a roller should be used.

MIXTURES FOR PERMANENT PASTURES.

For moist rich soil: Kentucky blue grass, 5; white clover, 4; red clover, 5; sweet scented vernal, 4; orchard grass, 7; meadow fescue, 2; wood meadow, 5.

For wet lands: White clover, 10; red top, 6; fowl meadow, 10; rough stalked meadow, 5; Italian rye grass, 7.

For dry, sandy soil: Meadow fescue, 7; orchard grass, 8; sweet scented vernal, 6; red clover, 5; white clover, 5.

The above mixtures are given merely as samples; anyone having a knowledge of the grasses can prepare a mixture of his own.

We have already spoken of most of the important meadow grasses, and we deem it unnecessary to repeat what has been said.

For lawns, the following mixture is valuable:

12 quarts	red top, (*Agrostis vulgaris*).
4 quarts	kentucky blue grass, (*Poa pratensis*).
2 quarts	white clover, (*Trifolium repens*).
4 quarts	sweet scented vernal, (*Anthoxanthum odoratum*).
2 quarts	wood meadow grass, (*Poa nemoralis*).
2 quarts	meadow fescue, (*Festuca pratensis*).
4 quarts	perennial rye grass, (*Lolium perenne*).
2 quarts	fowl meadow grass, (*Poa serotina*).
1 bushel.	

Sow at the rate of two (2) bushels per acre. If sown early in April it will form a good lawn by August.

WHEN TO CUT.

The proper time for cutting grass is a question that has been discussed as much as the question of wheat turning to cheat. It is a question that has never been settled, and we need practical tests to settle the matter. We mean by practical tests, the feeding of grasses cut at different periods of growth, noting the gain in flesh of animals fed on late cut grass and the gain of those fed on early cut, and observing which kind of hay will cause the greatest flow of milk, etc.

The only experiments of this kind in this country were made by Prof. J. W. Sanborn, at the New Hamshire Agricultural College.

After a number of experiments, he concludes as follows: "I have to say that I believe that timothy and clover hay, particularly the former, is worth more per pound, and for timothy thirty-five to forty per cent more per acre for cutting when sufficiently out of bloom, than when in bloom or prior to bloom. I would not be understood as saying that all vegetation thus advances in quantity and quality." From some experience I conclude this is true of corn fodder, that it increases in quantity and quality, and am inclined to believe it true of most vegetation.

The following analyses of grasses cut at different periods of growth were made by the Department of Agriculture at Washington:

AGROSTIS VULGARIS (Red Top).

	Album.	C. Fiber.	N. F. Extract.	Fat.	When cut.
	Per cent.	Per cent.	Per cent.	Per cent.	
Panicle not out	13.19	20.97	53.88	3.77	June 1
Panicle out, closed	13.61	20 87	54.13	4.05	" 1
In early bloom	12.73	21.64	54.46	3.62	" 19
In full bloom	11.02	22.02	56.82	2.87	" 23
Seed in the milk	10.44	19.43	60.02	3.51	July 1
Seed hard	9.44	20.66	58.08	4.25	" 1
Seed mature	8.89	21.75	61.32	2.74	" 9

PHLEUM PRATENSE (Timothy).

	Album.	C. Fiber.	N. F. Extract.	Fat.	When cut.
	Per cent.	Per cent.	Per cent.	Per cent.	
Spike invisible	12.54	19.91	54.31	4.60	June 1
Spike visible	11.90	21.03	57.26	3.40	" 1
Before bloom	10.33	22.03	54.19	3.63	" 23
In early bloom	10.20	22.70	57.21	3.85	" 23
In full bloom	9.90	21.93	58.93	3.58	" 18
Early seed	12.10	22.90	51.07	3.40	" 18

DACTYLIS GLOMERATA (Orchard Grass).

	Album......... Per cent.	C. Fiber........ Per cent.	N. F. Extract.. Per cent.	Fat........... Per cent.	When cut............
Panicle not out.........	15.97	18.76	50.86	4.12	April 23
Panicle closed..........	10.39	23.81	55.04	3.13	May 4
In full bloom...........	9.53	25.40	53.76	3.24	" 13
After bloom............	8.25	27.26	52.75	2.83	June 1

ALOPECURUS PRATENSE (Meadow Foxtail).

	Album......... Per cent.	C. Fiber........ Per cent.	N. F. Extract.. Per cent.	Fat........... Per cent.	When cut............
Heads just appearing...	15.73	18.21	53.16	4.69	April 19
Before bloom...........	13.58	22.40	51.66	4.46	May 1
In bloom................	10.81	23.78	54.30	3.36	" 10
After bloom............	8.62	25.36	54.35	3.50	" 12

POA PRATENSIS (Kentucky blue grass).

	Album	C. Fiber........	N. F. Extract..	Fat..........	When cut..........
	Per cent.	Per cent.	Per cent.	Per cent.	
Panicle just visible.....	19.28	18.43	48.74	4.88	April 23
Panicle spreading......	16.21	22.83	51.32	4.07	May 1
In full bloom...........	12.01	23.76	51.43	3.90	" 21
In seed.................	12.49	24.34	53.54	3.50	June 5

The preceding analyses furnish the data from which are derived the following general conclusions, viz.: That as a grass grows older its contents of matter decreases, ash decreases, fat decreases, albuminoids decrease, carbhydrates increase, crude fiber increases.

Although largely a matter of opinion, it would seem from the foregoing results that the time of bloom, or very little later, is the fittest for cutting grasses to be cured as hay. Later on, the amount of fiber becomes too prominent; the stalk grows hard and indigestible; and the albuminoids decrease, while the dry seeds are readily detached from their glumes and lost with their store of nitrogen.

From the Woburn experiments we learn that *Agrostis vulgaris* (Red top) yielded, at the time of flowering, 10,209 pounds of grass per acre, which lost in drying, 5,615 pounds, and afforded 532 pounds of nutritive matter. Cut when the seed were ripe, it yielded 9,528 pounds of grass and lost 4,764 pounds in drying, and gave only 231 pounds of nutritive matter.

Phleum pratense (timothy), grown on a clay loam, gave 40,837 pounds of green grass per acre, which lost 23,480 pounds in drying, and gave 1,595 pounds of nutritive matter. Cut when the seed was ripe, it gave about the same amount of green grass, but it lost in drying 21,440 pounds.

Dactylis glomerata (Orchard grass), cut at the time of flowering, yielded at the rate of 27,905 pounds per acre, which lost in drying, 16,045 pounds, and gave 1,089 pounds of nutritive matter.

Alopecurus pratensis (Meadow fox tail), Mr. Gould says of this grass: "One hundred pounds of this grass gives only nineteen and three-quarter pounds of dry hay, while timothy gives forty-two and three quarter pounds for the same weight of green grass."

Poa pretensis (Kentucky blue grass). This grass gave 10,209 pounds when green, and lost 7,337 pounds in drying, and 279 pounds of nutritive matter. Cut when the seed was ripe, it yielded 8,507 pounds to the acre, and lost in drying, 5,104 pounds, and gave 199 pounds of nutritive matter.

The Department of Agriculture at Washington has been doing a good work in giving us reliable chemical analyses of the many grasses. But, as we have already said, what we want is practical trials at the manger and with the scales. Such experiments successfully carried out, would be of great value to our farmers. This would be a good work for our Agricultural College, and if successfully carried out, would be appreciated by our farmers.

CLASSIFICATION OF THE GRASSES.

We propose to follow the arrangement of Bentham and Hooker, in describing the grasses, beginning with—

SERIES I.—PANICEÆ

Spikelets, consisting of one fertile terminal flower, and usually an inferior one, which is male or sterile.

Group I.—branches of the simple panicle spike-like, or variously branched, not produced beyond the spikelets.

PASPALUM.

We know of no common names that have been generally adopted for the members of this genus; they are not common in Missousi, but they flourish in the southern States, and they are *there* considered the most valuable grasses they have (See plate I.).

Spikelets spiked, or somewhat racemed in two to four rows on one side of a flattened or filiform rachis, jointed with their very short pedicels, plano-convex; awnless. The spikelets contain each one perfect flower inclosed within two outer membranaceous glumes. Flowers coriaceous, mostly obicular or ovate, flat on the inner side.

Paspalum læve (Smooth Paspalum).—Culms two to four feet high; leaves long, smooth, or somewhat hairy; spikes two to six near the top of the culm. It is a perennial, and is found growing in moist soil and wet places. No doubt this grass would prove valuable for some of the lowlands in the southeastern part of the State. We have seen it growing naturally there, and many of the culms were more than five feet in length.

Prof. Phares says that he has a neighbor who has always been widely known for the good condition in which he keeps all his animals, and for liberal feeding. For twenty-five years he has been feeding this grass, and for many years he has had a meadow of this grass alone, from which without seeding, he annually mows about two tons of hay per acre.

ANALYSIS. (Collier.)

Albuminoids	8.14 per cent.
Fat	2.76 "
Carbhydrates	33.00 "
Ash	6.43 "

Paspalum setaceum.—Culms one to three feet high, slender spikes mostly solitary on a long peduncle; dry fields and meadows; August.

Paspalum fluitans.—Culm one to three feet long, with creeping or floating base; spikes very numerous in a spiked raceme; found growing in swamps—flowers in August.

PANICUM (Panic Grass).

Spikelets panicled, racemed, or sometimes spiked; one perfect terminal flower, and usually a rudimentary one below; glumes two, but the lower one usually short or minute. The members of this genus are common, and some of them are very rich in nutritive matter; they may prove valuable on lands where the better grasses will not grow. The following species we have here:

Panicum filiforme (Slender Crab Grass).—Spikelets crowded, two or three together, about one-sixteenth of an inch long—no agricultural value.

Panicum glabrum.—Spikelets ovoid, crowded; the upper glume about as long as the abortive flower; found growing in sandy fields—flowers in August.

Panicum sanguinale (Crab Grass).—Every farmer is familiar with this grass, that springs up as if by magic in the midst of his corn, potatoes, etc. The culms are erect or spreading, one to two feet high; the leaves and sheaths are smooth or hairy; spikes four to fifteen (usually about six) at the summit of the culm. (See plate II.)

ANALYSIS. (Collier.)

Albuminoids	9.78 per cent.
Crude fiber	32.09 "
Nitrogen free extract	42.70 "
Ash	2.82 "

Prof. Phares says: "This grass varies much in size, and other respects according to soil and season. Stems have been measured seven feet long; it may yield from one to two tons of sweet, delicious hay per acre. According to the Woburn experiments, it yields 6,806 pounds of grass per acre, which looses 4,258 pounds by drying, and yields 119 pounds of nutritive extract."

Panicum agrostoides is very common in wet places; culm one to four feet high—flowers in August.

Panicum proliferum.—Culms two to three feet high, smooth leaves long, forming a tuft at the base of the culm. Along the Mississippi river from St. Louis southward.

Panicum capillare (Old Witch Grass).—Culm upright, often branched at the base, and forming a tuft; leaves large, and sheaths very hairy. This grass has a large, loose panicle, and when dry they are blown about by the wind. (See plate III.)

P. autumnale, P. virgatum, P. latifolium, P. clandestinum, P. microcarpon, P. pauciflorum, P. dichotomum. P. depauperatum, and P. crus-galli, are found growing in Missouri, but they are of no agricultural value. (See plates IV. and V.)

SETARIA (Bristly Foxtail Grass).

Spikelets altogether, as in *Panicum* proper, and awnless, but below the spikelets are several (sometimes one) bristles which are supposed to be abortive branchlets.

Setaria verticillata.—Bristles single or in pairs, barbed downwards; culm one to two feet high; flowers in August; found in cultivated grounds near dwellings.

Setaria glauca (Bottle Grass).—Bristles in clusters, barbed upwards; perfect flower, transversely wrinkled; culm two to four feet high. It is a vile weed, and every man's hand should be against it; cattle will not eat it, and insects spurn it. (See plate VI.)

Setaria viridis (Green Foxtail).—Fertile flower, striate lengthwise; bristles few in a cluster, longer than the spikelets; cultivated grounds; common.

Group 2.—Spikes or racemes simple, solitary, or rarely paniculate; spikelets surrounded by, or intermixed with abortive branches of the panicle, forming a lobed or bristly involucre which is deciduous with the spikelet.

CENCHRUS (Bur Grass, Sand Bur).

Cenchrus tribuloides.—Spikelets inclosed in a horny involucre, which is thickly clothed with hairs and studded with spinous processes; grows in sandy soil; flowers in August; utterly worthless.

Group 3.—Spikes one to many, in a common peduncle; rhachis produced beyond the uppermost spikelet.

SPARTINA (Cord Grass).

Spartina cynosuroides (Fresh Water Cord Grass).—Spikelets one flowered, much flattened, sessile along one side of the long triangular rhachis or spikes; glumes strongly compressed, keeled, the upper short armed; culm three to five feet high; leaves long and cord like; very common along the Mississippi and Missouri rivers.

ANALYSIS (Collier).

Albuminoids	8 41	per cent.
Crude fiber	22.10	"
Nitrogen free extract	46.07	"
Fat	2.55	"

Cattle will not eat this grass if they can get better. It has been used in the manufacture of coarse paper. (See plate VII).

TRIBE (2):—MAYDÆ.

COIX.

Coix Lachryma (Job's Tears).—Cultivated for ornament.

TRIPSACUM (Sesame Grass).

Tripsacum dactyloides. A perennial grass with broad rough leaves, and culms three to six feet high. Spikelets monœcius, in jointed spikes, staminate above, fertile below. Staminate spikelets two, sessile at each triangular joint of the rhachis, forming a one-sided two-ranked spike. Pistillate flowers deeply embedded in each joint of the rhachis. Moist soil; rare; flowers in July.

Prof. Phares says: "Some forty or more years ago many people in Louisiana planted patches of it, a few of which remain. All kinds of live stock eat it with a good relish when green and are fond of the sweet, nutritious but coarse hay." (See plate VIII).

ANALYSIS. (Collier's.)

Albuminoids	8.62	per cent.
Alkali extract	23.09	"
Amylaceous cellulose	20.84	"
Cellulose	26.59	"
Gum and dextrine	3.66	"
Sugars	8.84	"
Wax	0.68	"
Oil	1.72	"
Ash	5.96	"

TRIBE (3):—ORYZÆ.

Zizania aquatica (Indian Rice, Wild Rice).—This grass is found in great abundance in the south-eastern counties of the State. In Mississippi county it is very common, and is called swamp grass by the farmers living in that section. It remains green all winter, and during cold weather, when the swamps are frozen and cattle can get at it, they eat it with relish. The culms are eight to twelve feet high; leaves broad and long.

The panicle is one to two feet long, pyramidal in shape; the lower branches of the panicle are staminate, the upper erect, pistillate. Grain slender, half an inch long.

Mr. Gould says: "The Zizania is sometimes found in brackish waters, but its favorite haunts are in fresh waters. The Indians are very fond of the grain, and they store up large quantities of it in October when it is fully ripened. They gather it by beating it off into their canoes as they paddle through it. But the Indians are not the only customers for it, the reed birds (*Emberiza orysiovora*) resort in countless numbers to the muddy shores of our tide waters, when this grass is ripe, and fatten upon the seed." Flowers in August. (See plate IX.)

LEERSIA (False Rice, White Grass).

The members of this genus have one-flowered spikelets crowded in one-sided, panicled spikes or racemes.

Leersia oryzoides (Cut Grass, False Rice).—Panicle diffusely branched and often sheathed at the base, spikeless, flat, rather spreading in flower.

Leersia Virginica (White Grass).—Panicle simple. The spikelets closely appressed on the slender branches, around which they are partly curved.

Leersia lenticularis (Fly Catch Grass).—Spikelets broadly and imbricately covering each other; panicle simple, smoothish. The leaves and sheaths of these grasses are covered with minute hooked prickles; They grow in damp shady places, and are of no agricultural value—flowers in September.

TRIBE (4):—ANDROPOGONEAE.

Spikelets arranged along the rhachis of the spike or the branches of the panicle, most commonly in two's, or the terminal ones in three's.

Group (1):—Spikelets paniculate.

ERIANTHUS (Woolly Beard Grass).

Erianthus alopecuroides.—Culm four to six feet high, woolly, bearded at the joints; spikelets spiked, in pairs upon each joint of the slender rhachis; panicle contracted, the silky hairs longer than the spikelets, shorter than the straight awn. Dry soil; rare; flowers in September.

ANDROPOGON (Broom Grass, Blue Joint).

Perennial grasses with long rough leaves and wiry stems. Four species are common in Missouri.

Andropogon furcatus (Tall Blue stem).—Culm four feet high, and leaves smooth, bearing three to five straight and rather rigid spikes together at the naked summit, or fewer on lateral branches. This grass is very common on our prairies; it grows in bunches, and flowers in September. The flowering culms are tough and wiry and cattle will not eat them. Nurserymen often use the culms in packing trees. (See plate X).

COLLIER'S ANALISIS.

Albuminoids	6.90 per cent.
Crude fiber	21.98 "
N. Free extract	49.87 "
Fat	2.59 "

Andropogon scoparius (Slender Blue Stem).—Culm slender, two to four feet high, with many paniculate branches; spikes mostly single; leaves and sheaths hairy; common.

Andropogon argenteus.—Culm three feet high; spikes in pairs, silky, with long white hairs—flowers in October.

Andropogon Virginicus (Broom Sedge).—Culms three feet high, branched above; leaves twelve to fifteen inches long.

Prof. Phares says: "When this grass dries in the fall it may be burned off, and in the spring the perennial roots send up a new crop of tender, nutritious herbage which cattle, horses, etc. relish and eat with much benefit.

CHRYSOPOGON (Wood Grass).

Chrysopogon nutans (Wild Sorghum).—Flowers loosely paniculate; fertile spikelets one flowered, sessile between two pedicellate male or barren spikelets at the end of the slender branches of the panicle. The culms are three to five feet high, having at the top a shining brown panicle. Flowers in September; found growing with the last. Contains only 2.74 per cent. albuminoids. (See plate XI).

SORGHUM.

Spikelets much like the last; glumes of the fertile spikelets hardening after flowering.

Sorghum helapense (Johnson Grass).—This grass is attracting attention in the South. It is a perennial grass, and the culms are from four to six feet long. It is said to have been introduced into this country about 1830.

Dr. Vasey says: "In 1840 or 1845 William Johnson of Alabama obtained some of the seed and sowed it upon his farm, whence it derived its name of Johnson grass."

ANALYSIS. (Collier's).

Albuminoids	10.14 per cent.
Crude fiber	21.17 "
Nitrogen free extract	44.77 "
Fat	2.43 "
Ash	6.92 "

S. vulgare, Indian millet; *S. cernum*, Guinea corn; and *S. saccharinum*, the African sugar cane, belong to this genus.

TRIBE (5):—PHALARIDEÆ.

Rhachis articulated above the outer glumes.

PHALARIS (Canary Grass).

Named from the Greek *phalos*, *shining*, in allusion to the polished paleæ. Spikelets crowded in a dense or spiked panicle. Two neutral flowers, one on each side at the base of the perfect one.

P. canariensis (Canary Seed Grass).—Perfect flower, flatish, awnless, of two shining paleæ; glumes wing keeled; culm one to two feet high; cultivated for the seed, which is used as food for canary birds; found growing in waste places; flowers in September; produces about twenty-five bushels of seed per acre.

Anthoxanthum and *Alopecurus* belong to this group. See cultivated grasses.

TRIBE (6):—AGROSTIDAE.

Spikelets paniculate; rhachis not produced beyond the flower.

ARISTIDA (Triple Armed Grass).

Glumes unequal, often bristle pointed; lower pallet tipped with three arms, the upper pallet much smaller; the culms are branching; leaves narrow, often involute. The members of this genus are usually found growing along roadsides, and they are a living evidence of a worn out soil.

A. ramosissima.—Root annual; culms diffuse; awns very unequal, the two lateral ones merely short, erect bristles—flowers in August.

A. gracilis.—Awns unequal, but similar; culms slender, erect, six to eighteen inches high—flowers in August.

A. purpurascens.—Awns nearly equal, one inch long; culm simple, or nearly so; leaves smooth, involute when dry—August. (See plate XII.)

ANALYSIS. (Collier).

Albuminoids	3.70 per cent.
Crude fiber	28.32 "
Nitrogen free extract	52.60 "
Fat	2.22 "
Nutritive ratio............1: 14.8.	

A. oligantha.—Spikelets large; awns one and a half to three inches long; culms smooth, two to three feet high; leaves involute when dry—flowers in September.

A. purpurea (Western Beard Grass).—This grass is common in the western part of the State; culms about two feet high, much branched; otherwise as the last.

STIPA (Feather Grass).

Spikelets one flowered, terete, spicate or paniculate; glumes narrow, involute, with a simple twisted arm from the apex. Perennials with narrow, involute leaves and a loose panicle. These grasses usually grow in tufts, and they are commonly called bunch grasses.

S. avenacea (Black Oat Grass).—Culms about three feet high; panicle narrow; awn twisted, about three inches long; leaves six to eight inches long—flowers in June.

S. spartea (Porcupine Grass).—Culm two to three feet high; panicle contracted; awn about six inches long; flowers in June—no agricultural value.

ORYZOPSIS (Mountain Rice).

Spikelets one flowered; glumes herbaceous, several nerved, nearly equal. commonly rather larger than the oblong flower. Perennials with rigid leaves and a narrow panicle.

O. melanocarpa.—Culm two to three feet high; leaves narrow, taper pointed; panicle simple, or sparingly branched; spikelets loosely racemed; arms thrice the length of the blackish paleae. Cattle will sometimes eat this when they are unable to obtain other grasses.

MILIUM (Millet Grass).

M. effusium is a native of Europe; the culms are three to six feet high, erect, and bearing seven to eight narrow leaves; panicle eight to twelve inches long, the branches exceedingly long. From the "Woburn experiments" we learn that 7,857 pounds was cut from one acre, and this lost 4,794 pounds in drying, and gave 214 pounds of nutritive matter.

MUHLENBERGIA (Drop Seed Grass).

The members of this genus are quite common in Missouri. They are found growing along streams and in damp, shady places; they are mostly perennials; having one flowered spikelets in a contracted panicle; the culms and leaves are very thin, and the hay is exceedingly bulky.

M. diffusa (Nimble Will).—Culms diffuse, much branched, eight to eighteen inches high; panicle contracted rather loosely; many flowered.

ANALYSIS. (Collier.)

Albuminoids	8.57	per cent.
Crude fiber	20 19	"
Nitrogen free extract	47.44	"
Fat	1.55	"

Prof. Phares says: "The analysis shows that those who esteem it as a butter producing grass have good reasons for their faith. Some think it also imparts a specially agreeable flavor to butter. Some say their stock are fond of it, and that feeding on it in the range, they become sleek and fat." (See plate XIII).

M. glomerata.—Culms upright, one to two feet high, sparingly branched; the simple panicle oblong, linear, contracted into an interupted glomerate spike—flowers in September.

M. Mexicana.—Culms ascending, much branched; the branches very leafy; panicles, lateral and terminal, contracted; the branches densely spike clustered—September (See plate XIV).

M. sobolifera.—Culms ascending, sparingly branched; panicle simple, contracted—flowers in August.

ANALYSIS.

Albuminoids	17.42 per cent.
Crude fiber	15.15 "
Nitrogen free extract	35.52 "
Fat	4.94 "

M. sylvatica.—Culms ascending, much branched, two to four feet high; panicles contracted, many flowered; grows with the last.

M. Willdenovii.—Culms upright, three feet high, simple or sparingly branched; panicle slender, loosely flowered; found growing in rocky places; rather common—August.

BRACHYELYTRUM.

B. aristatum.—Spikelets one flowered, with a conspicuous filiform pedicel of a second abortive flower; culms simple, one to three feet high; panicle three to five inches long. This grass in not common in Missouri. It flowers in August, and is usually found growing in shady places.

PHLEUM.

P. pratense (Timothy).—See cultivated grasses.

SPOROBOLUS (Drop Seed Grass).

Spikelets, one (rarely two) flowered, in a contracted or open panicle; glumes unequal, the lower smaller, often acute, unawned, one to three nerved.

S. cryptandrus.—Culms two to three feet high; leaves flat, about one-fourth of an inch wide. The base of the pyramidal panicle enclosed in the upper sheath. This grass grows in dry sandy places, and flowers in August. (See plate XV).

S. heterolepsis.—This species is usually found growing in dry sandy soil. It is one of our common grasses, flowering in August. The lower leaves are long (1 to 2 feet) and narrow, and they become involute when dry. When bruised the plant emits an unpleasant odor. We have never seen cattle eat it; they seem rather to avoid it, owing perhaps to its unpleasant scent.

Agrostis.—See cultivated grasses.

CINNA (Wood Reed Grass).

C. arundinacea.—The spikelets of this grass are one-flowered, crowded in an open flacid panicle. The glumes are lanceolate, acute, strongly keeled. The paleae are much like the glumes, the lower longer than the upper, short awned on the back. The culms are two to five feet high; leaves long and about three fourths of an inch wide; panicle six to fifteen inches long, the branches and pedicels spreading in flower, afterwards erect. Flowers in August, and is found growing in damp shady woods. (See plate XVI).

ANALYSIS (Collier's).

Albuminoids	5.33	per cent.
Fiber	25.40	"
Nitrogen free extract	46.69	"
Fat	2.55	"

DEYEUXIA (Calamagrostis).

D. Canadensis (Blue Joint Grass).—Spikelets one-flowered, and often with a rudiment of a second abortive flower in an open purplish panicle; flowers surrounded at the base by a copious tuft of white bristly hairs. This is a valuable grass for wet meadows. It makes a sweet, nutritious hay, which is greedily eaten by cattle.

ANALYSIS.

Ash	4.65	per cent.
Fat	2.33	"
Nitrogen free extract	41.23	"
Crude fiber	44.34	"
Albuminoids	7.45	"

Mr. Gould says: "It is certain that cattle relish it very much, both in the green and dry state, and when made into hay; it is equally certain that the farmers who have it on their farms believe it to be one of the best grasses of their meadows." (See plate XVII).

D. confinis.—Spikelets similar to the last; panicle enlongated, narrow, five to eight inches long; culms three to four feet high; flowers in August; no agricultural value.

AMMOPHILA (Calamagrostis).

A. longifolia.—Spikelets one flowered, in a contracted panicle; the panicle is four to eight inches long, closed at first but afterwards spreading. The culms are four to six feet high, stout. This grass is found only in the western part of the State; it flowers in August, and is usually found growing in dry, sandy soil.

TRIBE (7):—AVENEA.

Spikelets, two to many flowered, paniculate, or rarely spicate.

DESCHAMPSIA (Aira).

D. cœspitosa (Hair Grass).—Spikelets two flowered, mostly in a loose panicle with slender branches. The culms grow in tufts and are two to four feet high. The leaves are flat and narrow, and involute when dry.

Dr. Vasey says: "This is an exceedingly variable species, having a very wide distribution in this and other countries. It is rare east of the Mississippi; but on the elevated plains and in the Rocky mountains, also in California and Oregon, it is one of the common bunch grasses." (See plate XVIII).

DANTHONIA (Wild Oat Grass).

The spikelets of this genus are three to seven flowered; the lower palea bears an awn, composed of the three middle nerves, which is spirally twisted at the base.

D. spicata.—Culms tufted, one to two feet high; leaves short, narrow and soon involute. This is one of our most common grasses; it grows abundantly on rocky hills and worn out soil. We have never seen it eaten by cattle, but no doubt they would eat it if nothing better could be obtained.

ANALYSIS. (Collier's).

Albuminoids	5.79 per cent.
Crude Fiber	29.11 "
Nitrogen free extract	56.32 "
Fat	3.80 "
Ash	4.38 "

TRIBE (8):—CHLORIDEAE.

One, or rarely two fertile flowers in the spikelet.

CYNODON (Bermuda Grass).

C. dactylon.—This grass is a native of Southern Europe, and is now cultivated and naturalized in all our southern states. The spikelets are one-flowered, with a mere naked, short, pedicelled rudiment of a second flower. The spikes (3 to 5) are usually digitate at the summit of the naked flowering culms; the culms are diffusely branched, and clothed with short, succulent leaves.

Prof. Kilebrew, of Tennessee, says: "It revels in sandy soils, and has been grown extensively on the sandy hills of Virginia and North and South Carolina. It is used extensively on the southern rivers to hold the levees, and embankments of the roads."

ANALYSIS.

Albuminoids	13.42 per cent.
Crude Fiber	23.29 "
Nitrogen free extract	52.61 "
Fat	1.57 "

Unless protected it would be winter killed in this climate; and hence, it has little or no value with us. (See plate XIX).

SCHEDONNARDUS.

S. Texanus (*Lepturus pawiculatus*).—Spikelets solitary at each joint of the filiform rhachis, and partly immersed in the excavation;

one flowered; culms, slender, six to twenty inches long, naked and curved above, bearing racemosely disposed, thread like spikes; no agricultural value.

BOUTELOUA (Muskit grass).

Spikelets crowded, and closely sessile in two rows on one side of a flattened rhachis, each consisting of one perfect flower and a stalked pedicel bearing empty glumes.

B. hirsuta.—Tufted; from an annual root; eight to twenty inches high; spikes one to four; found growing in dry, sandy soil; flowers in August.

B. racemosa, (*B. curtipendula Gr*).—Culms tufted, from perennial rootstalks; one to three feet high; spikes about half an inch long, thirty to sixty in number, in a long, slender raceme. This grass is quite common in Missouri. It flowers in August; and grows in dry, limestone soil.

ELEUSINE (Crab grass).

E. Indica (Dogs tail or wire grass).—Spikelets two to six flowered, with a terminal naked rudiment, closely imbricated on one side of a flattish rhachis; the spikes digitate. Annual with flat leaves; culms ascending, flattened. This grass seems particularly fond of growing in gravel and brick walks, and is often difficult to eradicate.

ANALYSIS.

Albuminoids	13.60 per cent.
Crude Fiber	31.04 "
Nitrogen, Free Extract	34.01 "
Fat	2.14 "

LEPIOCHLOA.

L. mucronata.—Spikelets many (three to five) flowered, the uppermost imperfect, spiked on one side of a long filiform rhachis; the spikes racemed, twenty to forty in number. This is an annual grass, and is usually found growing in dry, sandy places; flowers in August.

COLLIER'S ANALYSIS. (Specimen from Texas.)

Albuminoids	7.70 per cent
Crude fiber	31.74 "
Nitrogen, free extract	46.75 "
Fat	2.05 "

TRIODIA (Tricuspis).

Triodia sesleriodis (Tall Red Top).—The spikelets of this grass are five to seven flowered; the glumes are shorter than the flowers; lower pallet three nerved, the nerves extending beyond the edge into three cusps or teeth, hence the name, *tricuspis*; panicle large and showy and of a shining, purplish color; culm smooth, three to five feet high. This large, showy grass flowers in September. It grows in meadows and pastures, and is one of our common grasses. The culms are tough and wiry, and cattle are not fond of them. The long, wiry culms are valuable for packing trees, and the grass is usually used for that purpose.

ANALYSIS.

Albuminoids	6.30 per cent.
Crude fiber	37.72 "
Nitrogen, free extract	48.86 "
Fat	1.99 "

TRIBE 8.—FESTUCACEÆ.

Spikelets few flowered; flowering glumes, mostly three nerved, three to many armed.

ARUNDO.

A. Donax (Giant Reed Grass).—A tall grass, native of Mexico; cultivated for ornament.

PHRAGMITES (Reed).

Name from *phragmites*, *growing in hedges*, which this grass does not. Spikelets three to seven flowered, the flowers rather distant, silky, villous at the base.

P. communis.—Panicle ample, flowers equalling the wool; flowers in September; culm five to twelve feet high; found growing in swamps and near rivers. This grass is widely distributed. It is found in Europe, Asia, Africa and Australia. It is used for thatching, and also for making fences in some sections of the eastern continent.

KOELERIA.

K. cristata.—Spikelets three to seven flowered, crowded in a dense, narrow, spike-like panicle; glumes membranaceous, keeled, unequal, lanceolate; culms one to two feet high; root-leaves twelve to eighteen inches long; flowers in July, and is usually found growing in dry, sandy places. (See plate XXIII).

Dr. Vasey says: "This grass has a very wide diffusion, both in this country and in Europe and Asia. It favors dry hills and sandy prairies, and on the great plains it is one of the commonest species."

EATONIA.

Named for Amos Eaton, author of "A Manual of Botany of the United States." Spikelets usually two-flowered, with an abortive rudiment, numerous, in a contracted or slender panicle, smooth: glumes somewhat equal in length, but very dissimilar, a little shorter than the flowers; the lower narrowly linear, keeled, one nerved; the upper broadly obovate, folded round the flowers.

E. obtusata.—Panicle dense and contracted; culm one to two feet high; flowers in June; found growing on dry hills; common.

E. Pennsylvania.—Panicle long and slender, loose; flowers in June; found growing in moist woods, usually near streams. Cattle will sometimes crop the species of this genus when young, but it soon becomes converted into woody fiber, and is then avoided by all animals. (J. S. Gould.)

ERAGROSTIS.

Name from *era*, *earthy*, in allusion to the procumbent habit of the original species. Spikelets, two to seventy flowered; lower palea three nerved, not webby haired at the base; culm often branching; leaves linear, frequently involute; throat of the sheath clothed with long hairs. Graceful grasses, but they have no agricultural value.

E. reptans.—Flower branches two to five inches high; spikelets, ten to fifty flowered; flowers in August; found growing along streams in sandy or gravelly soil.

E. Pœoides.—Culms six to fifteen inches high; spikelets eight to twenty flowered; smooth, except the lower sheath, which is often hairy. (See plate XXIV.)

Var. megastachya.—Spikelets ten to fifty flowered; sheaths mostly glabrous. (Native of Europe.)

E. pilosa.—Spikelets five to ten flowered; culm six to twelve inches high; flowers in September; sandy soil; common.

E. Frankii.—Spikelets, two to five flowered; culm sparingly branched; eight to eighteen inches high; flowers in September.

E. capillaris.—Spikelet two to four flowered; panicle one to two feet wide, becoming very diffuse; flowers in August; common in dry and sandy fields.

E. pectinacea.—Spikelets five to fifteen flowered; panicle wide and diffuse, pulpish tinged; main branches of panicle bearded in the axils.

Var. spectabiles.—Spikelets larger, mostly smooth; flowers in September; found growing in meadows and pastures; common.

E. tennis.—Spikelets two to six flowered in an open diffuse panicle; culms one to two feet hight; leaves rigid, one and a half to two feet long; flowers in August; and is usually found in dry, sandy soil.

MELICA.

Name from *melo—honey.* Spikelets, two to five flowered; usually convolute around each other; the upper, one to three flowered, imperfect; glumes usually large, scarious margined, convex, obtuse.

M. mutica.—Panicle simple or branched; glumes unequal, the larger almost equalling the spikelet; a perennial grass growing in tufts; usually found in damp, shady woods; flowers in June.

DIARRHENA.

Name composed of *dis, two,* and *arren, man*; from the two stamens.

D. Americana.—Spikelets several flowered, the uppermost imperfect; glumes unequal, shorter than the flowers; panicle narrow and loose; a perennial grass with smooth culms two to three feet high; flowers in July; found in shady woods; no agricultural value.

UNIOLA (Spike Grass).

Spikelets closely many flowered, very flat, and two-edged; one or more of the lowest flowers sterile; glumes lanceolate, compressed, keeled.

U. latifolia.—Spikelets nine to thirty flowered; panicle open; flowers acute, all but the lowest perfect; flowers in August; culm three to four feet high; found growing on damp, shady hillsides. This is a beautiful grass with large drooping spikelets, and broad leaves; cattle are fond of it. (See plate XXV.)

ANALYSIS.

Albuminoids	9.32 per cent.
Crude fibre	31.91 "
Nitrogen free extract	29.25 "
Fat	2.67 "
Nutritive ratio 1: 3.4	

BRIZA.

Name from *brizo, to slumber*—in allusion to the pendant branches.

B. maxima.—Spikelets many flowered, ovate or heart shaped; glumes roundish, unequal, purple. A showy grass, often cultivated for ornament. (Native of Europe.)

GLYCENA (Manna Grass).

Name from *glukeros, sweet*—in allusion to the taste of the grain. Spikelets terete or flattish, several too many flowered, in a narrow or diffuse panicle; flowers, mostly early deciduous, by the breaking up of the rachis into joints; glumes shorter than the flowers, unequal, membranaceous, one to three nerved; peleae nearly equal, the lower rounded on the back.

G. Canadensis (Rattle Snake Grass).—Spikelets six to eight flowered; panicle oblong, pyramidal; culmn two to three feet high; found growing in wet, swampy places; flowers in July. (See plate XXIX.)

G. nervata.—Spikelets, three to seven flowered; panicle capillary; culm one to three feet high; flowers in June; very common; found growing in small streams and shallow water.

ANALYSIS.

Albuminoids	8.06 per cent.
Crude fiber	24.17 "
Nitrogen free extract	45.43 "
Fat	2.74 "
Nutritive ratio ....1: 6.	

G. fluitans.—Culms three to four feet high, thick and leafy; found growing in shallow water. (Jackson Co. Bush.)

G. arundinacea (Tall Red Grass).—Spikelets five to nine flowered; panicle large, eight to fifteen inches long; culm three to four feet high, very leafy; flowers in June; found growing in wet places. (See plate XXVIII).

BROMUS (Cheat Orchis).

Spikelets five to many flowered, in a dense or diffuse panicle; glumes unequal, membranaceous, the lower one to five, the upper five to nine nerved, awned or thistle pointed from below the mostly two cleft tip.

B. secalinus (Cheat).—Spikelets eight to ten flowered; panicle spreading; flowers in June; common in wheat fields. This grass has no value and is universally regarded as a pest in the grain field.

ANALYSIS.

Albuminoids	6.61 per cent.
Crude fiber	20.39 "
Nitrogen free extract	49.11 "
Fat	3.30 "
Nutritive ratio..................1: 8.2.	

(See plate XXXI).

B. racemosus.—Panicle erect, contracted in fruit; flowers closer and more imbricated than the last; flowers in June; found with the last.

B. kalmii (Wild Cheat).—Spikelets seven to twelve flowered, densely silky all over; panicle simple, three to four inches long; culm two to three feet high; flowers in June; woods; common; perennial.

B. cilliatus.—Spikelets seven to twelve flowered; panicle compound, very loose; flowers lanceolate, tipped with an awn half to three-fourths of its length; flowers in August.

B. sterilis.—Panicle very loose, the slender and nearly simple branches drooping; spikelets six flowered; flowers long awned; flowers in July; native of Europe.

AGROPYRUM (Triticum).

Spikelets several flowered, compressed, keeled, single at each joint and placed with the side against the rhachis.

A. repens (Couch Grass).—Spikelets four to eight flowered; culm two to three feet high; rootstocks extensively creeping. This is a vile weed, and when it has obtained a footing is very difficult to get rid of. (See plate XXXII.)

A. canium (Awned Wheat Grass).—No creeping rootstocks; spikelets four to five flowered; culms one to two feet high; leaves flat; flowers in July.

HORDEUM (Barley).

Spikelets one flowered, with an awl shaped rudiment of a second flower, three at each joint of the rhachis, the central spikelet of the cluster perfect and sessile, the latteral ones shut, stalked and imperfect; glumes side by side, two to each spikelet, or six at each joint.

H. jubatum (Squirrel-tail Grass).—Spikelets as in the generic description; the awn of the perfect flower two inches long; flowers in June. Occasionally cultivated for ornament; has no aricultural value; perennial.

H. pusillum.—Lateral flowers awnless but pointed, perfect flower bearing an awn nearly twice the length of its palea; flowers in June; culm four to ten inches high; pastures; rare.

H. vulgaris is the cultivated, two-rowed barley.

H. distichum is the four and six rowed barley.

ELYMUS (Wild Rye).

From the Greek *elno*, *to roll up*, in allusion to the enwrapping paleae. Spikelets two to four at each joint of the rhachis, all fertile and alike, one to seven flowered; glumes two for each spikelets, forming an involucre to the cluster.

E. Virginicus.—Spikelets two to three flowered, two to three together; spike three inches long, rigidly upright; culm two to three feet high; flowers in August; found in shady, damp woods; common.

E. Canadensis.—Spikelets mostly in pairs, three to five flowered; spike five to nine inches long, curving.

(See plate XXXIII.)

ANALYSIS.

Albuminoids	4.17 per cent.
Crude fiber	29.70 "
Nitrogen, free extract	43.52 "
Fat	3.18 "
Nutritive ratio, 1: 11.2	

Var. glaucifolus is pale and smooth; flowers in August; culm three to four feet high; along fence rows and in shady woods.

E. striatus.—Spikelets mostly in pairs, one to two (rarely three) flowered; spike slender, upright or slightly nodding; culm two to three feet high; flowers in August; rocky woods. Cattle will not eat these grasses if they can find anything better.

ASPRELLA (Gymnostichum).

Spikelets two to four flowered, or sometimes solitary on each joint of the rhachis.

A. hystrix (Bottle-brush Grass).—Spike upright, three to six inches long; spiklets spreading. It resembles the brush used by druggists for washing bottles, hence the name. Culm two to three feet high; flowers in August. It has no known economic value.

ARUNDINARIA (Cane).

A. tecta (Small Cane).—This large grass is found only in the southeastern part of the State. The culms are fifteen to twenty feet high and are used for fishing rods, pipe stems and various other purposes. Cattle are very fond of the leaves in winter, and find protection from the driving rain or piercing winds under the dense roof of the cane brake.

GLOSSARY.

Abortive.—Imperfect formation of a part.

Annual.—Living but one season.

Anther.—The essential part of the stamen, and which contains the pollen.

Appressed.—pressed together.

Articulated.—Jointed; connected by a joint or joints.

Ascending.—Rising obliquely from the ground.

Awn.—A bristle-like process proceeding from the glumes or paleae of many grasses.

Biennial.—Living through two seasons.

Boat-shaped.—Concave within and convex without.

Bristles.—Short stiff hairs.

Bulbous.—Thickened like a bulb.

Capillary.—Hair-like; very slender.

Cartilaginous.—Firm and tough.

Chaff.—The dried glumes and pallets of grasses.

Chartaceous.—A texture resembling paper.

Ciliate.—Having the margins or nerves fringed with hairs.

Compressed.—Flattened laterally.

Contorted.—Twisted.

Convolute.—Rolled together inwards from the margin.

Coriaceous.—Of a leathery consistency.

Culm.—The stalk or stem of grasses.

Cuspidate.—Ending in a stiff point.

Deciduous.—Falling off at the usual time.

Decumbent.—Leaning on the ground, but rising at the top.

Digitate.—Dividing from a common point.

Entire.—Without notches or divisions.

Equal.—Alike in length.

Exserted.—Extending beyond.

Fertile.—Producing fruit.

Fibrous.—Thread-like.

Geniculate.—Bent abruptly at one angle, like a knee.

Glabrous.—Smooth; without hairs.

Glaucous.—Having a light blueish green color.

Glomerate.—Clustered in small roundish heads.

Glumes.—The chaff like covering of the flowers.

Indigenous.—Growing naturally, not brought from some other country.

Involute.—Rolled together inwards.

Keel.—An elevated, longitudinal ridge in the middle of a glume or palea.

Ligule.—A tongue like appendage at the upper part of the sheath of a leaf.

Membranaceous.—Thin like a membrane.

Monœcious.—Having staminate and pistillate flowers separate, but on the same plant.

Mucronate.—Abruptly tipped with a short awn.

Nerves.—The ribs or veins of a leaf, glume, etc.

Neutral.—Having neither stamens nor pistils.

Palea or pallet.—The inner scale or chaff of the proper flower.

Panicle.—A branch and subdivided stem bearing the spikelets.

Pedicel.—A small branchlet supporting a spikelet.

Peduncle.—The main stem or stalk of a flower spike.

Perennial.—Living year after year.

Perfect—Having both stamens and pistils in the same flower.

Petiole.—The sheath or stem of a leaf.

Pistil.—The central or female organ of a flower.

Pistillate.—Having pistils only, without stamens.

Pollen.—The fertilizing powder contained in the anthers.

Pubescent.—Clothed with short and stiff hairs.

Rhachis.—The axis or stem on which the flowers of a spikelet are arranged; also the common axis of a close spike or of a panicle.

Rootstock.—A horizontal under ground stem.

Serrate.—Having teeth on the margin, pointing toward the apex.

Sessile.—Without a foot-stalk or pedicel.

Sheath.—The part of the leaf which encloses the stalk.

Spike.—A collection of sessile, or nearly sessile flowers on a close narrow axis.

Spikelet.—A flower or cluster of flowers, having one pair of outer glumes.

Stamen.—The male organs of a flower.
Staminate—Having stameus only.
Sterile.—Imperfect flowers, not producing seed.
Truncate.—Abruptly cut off at the apex.
Villous.—Velvety.

INDEX OF GRASSES.

Agropyrum canium........ 116
Agropyrum repens........ 116
Agrostis alba........ 78
A. elata........ 79
A. perennans........ 78
A. scabra........ 79
A. vulgaris........ 78
Alopecurus pratensis........ 77
Ammophila longifolia........ 108
Andropogon furcatus........ 101
Andropogon scoparius........ 102
Andropogon Virginicus........ 102
Anthoxanthum odoratum........ 86
Aristida gracilis........ 104
Aristida obligantha........ 104
Aristida purpurascens........ 104
Aristida purpurea........ 104
Aristida ramosissima........ 104
Arrhenatheum avenaceum........ 109
Arundo Donax........ 111
Arundinaria tecta........ 118
Asprella hystrix........ 117
Bouteloua hirsuta........ 110
Bouteloua racemosa........ 110
Brachyelytrum aristatum........ 106
Briza maxima........ 114
Bromus cilliatus........ 116
Bromus kalmii........ 116
Bromus racemosus........ 116
Bromus secalinus........ 115
Bromus sterilis........ 116
Cenchrus tribuloides........ 99
Chrysopogon nutans........ 102
Cinna arundinacea........ 107
Coix lachryma........ 99
Cynodon dactylon........ 109
Dactylis glomerata........ 76
Danthonia spicata........ 108
Deschampsia cæspitosa........ 108
Deyeuxia Canadensis........ 107
Deyeuxia confinis........ 108
Diarrhena Americana........ 113
Eatonia obtusata........ 112
Eatonia Pennsylvania........ 112
Eleusine Indica........ 110
Elymus Virginicus........ 117
Elymus Canadensis........ 117
Elymus striatus........ 117
Eragrostis capillaris........ 113
E. Frankii........ 113
E. pectinacea........ 113
E. pectinacea, variety spectabilis.... 113
E. pilosa........ 113
Eragrostis reptans........ 113
E. tennis........ 113
Erianthus alopecuroides........ 101
Festuca durinscula........ 84
F. elatior........ 84
F. nutans........ 85
F. ovina........ 84
F. tenella........ 84
Glycena arundinacea........ 113
G. Canadensis........ 114
G. fluitans........ 115
G. nervata........ 115
Hordeum jubatum........ 116
Hordeum pusillum........ 116
Koeleria cristata........ 112
Leersia lenticularis........ 101
Leersia oryzoides........ 101
Leersia Virginica........ 101
Leptochloa mucronata........ 110
Lolium perenne........ 85
Melica mutica........ 113
Milium effusium........ 105
Muhlnebergia diffusa........ 105
M. glomerata........ 105
M. Mexicana........ 105
M sylvatica........ 106
M. Wildenovii........ 106
Oryzopsis melanocarpa........ 104
Panicum agrostoides........ 98
P. autumnale........ 98
P. capillare........ 98
P. clandestinum........ 98
P. crus-galli........ 98
P. depauperatum........ 98
P. dichotomum........ 98
P. filiforme........ 97
P. glabrum........ 97
P. latifolium........ 98
P. microcarpon........ 98
P. pauciflorum........ 98
P. proliferum........ 98
P. sanguinale........ 98
P. virgatum........ 98
Paspalum fluitans........ 97
Paspalum lœve........ 96
Paspalum setaceum........ 97
Phalaris arundinacea........ 103
Phalaris canariensis........ 103
Phleum pratense........ 106
Phragmites communis........ 112
Poa alsodes........ 83
P. annua........ 83
P. arachnifera........ 84

P. brevifolia.......... 83
P. compressa.......... 82
P. flexuosa.......... 83
P. nemoralis.......... 83
P. pratensis.......... 79
P. serotina.......... 82
P. sylvestris.......... 83
Setaria glauca.......... 99
Setaria verticillata.......... 98
Setaria viridis.......... 99
Spartina cynosuroides.......... 99
Sorghum cernum.......... 103
Sorghum helapense.......... 102
Sorghum saccharinum.......... 103
Sorghum vulgare.......... 103
Stipa avenacea.......... 104
Stipa spartea.......... 104
Sporobolus cryptandrus.......... 106
Sporobolus heterolepsis.......... 106
Schedonnardus Texanus.......... 110
Trifolium pratense.......... 86
Trifolium repens.......... 88
Triodia sesleriodis.......... 111
Tripsacum dactyloides.......... 100
Uniola latifolia.......... 114
Zizania aquatica.......... 100

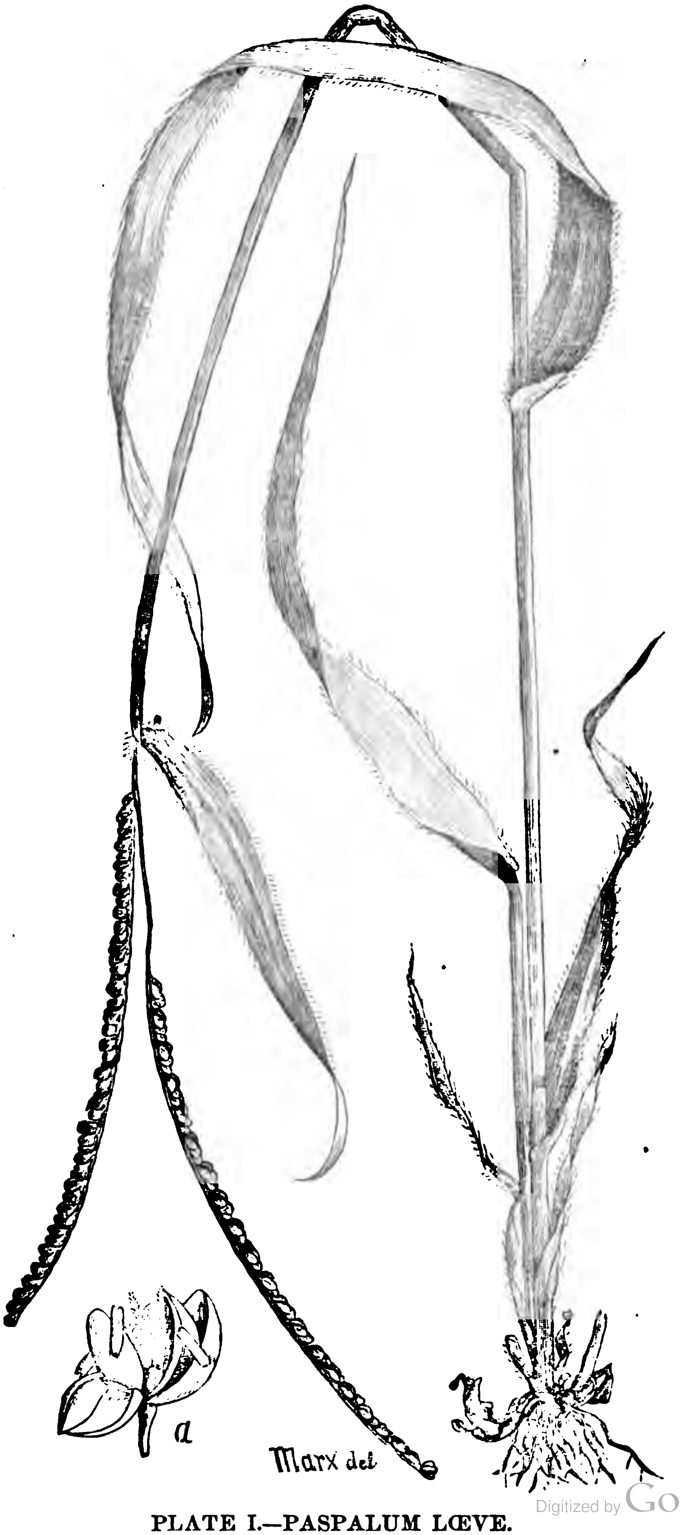

PLATE I.—PASPALUM LŒVE.

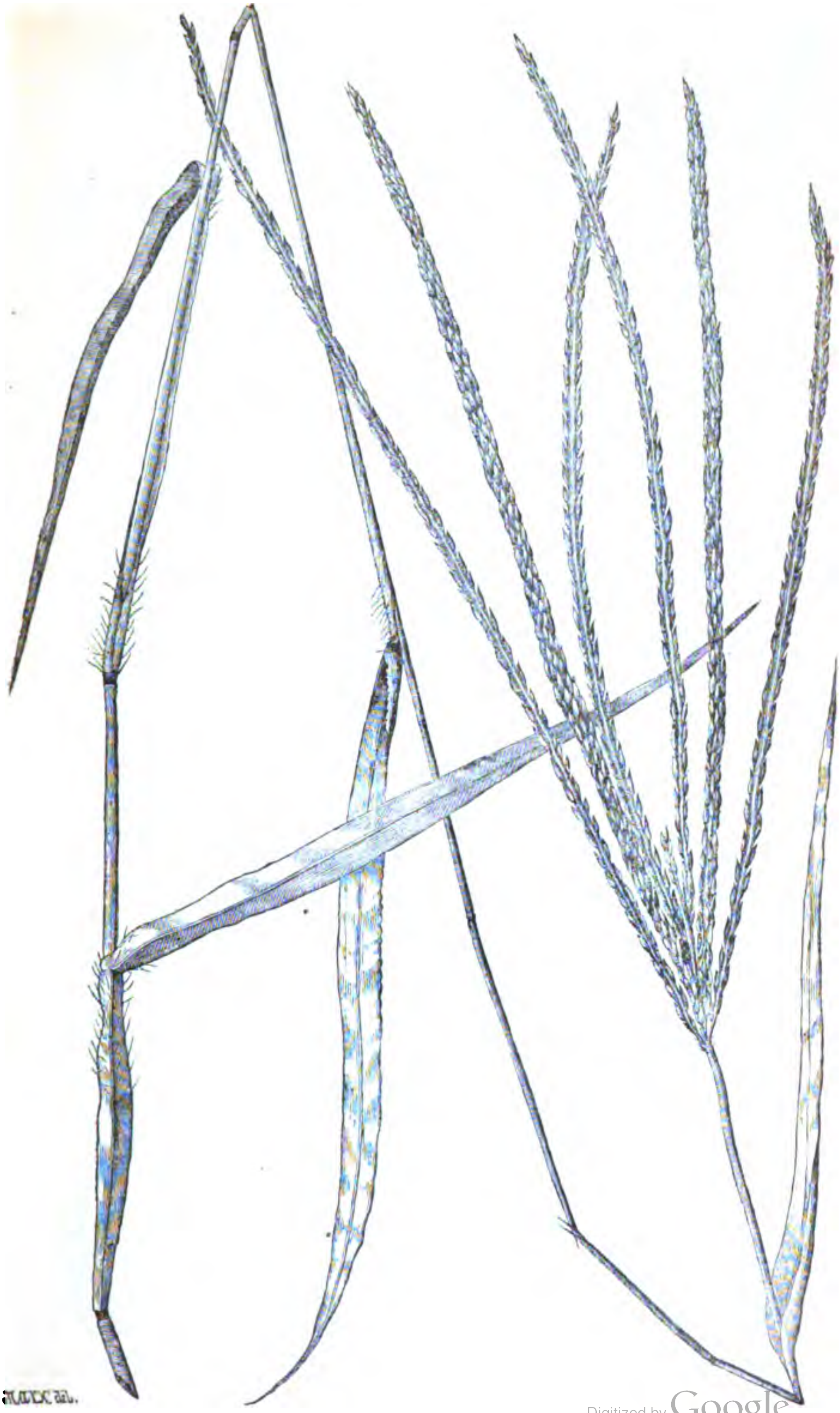

PLATE II.—PANICUM SANGUINALE.

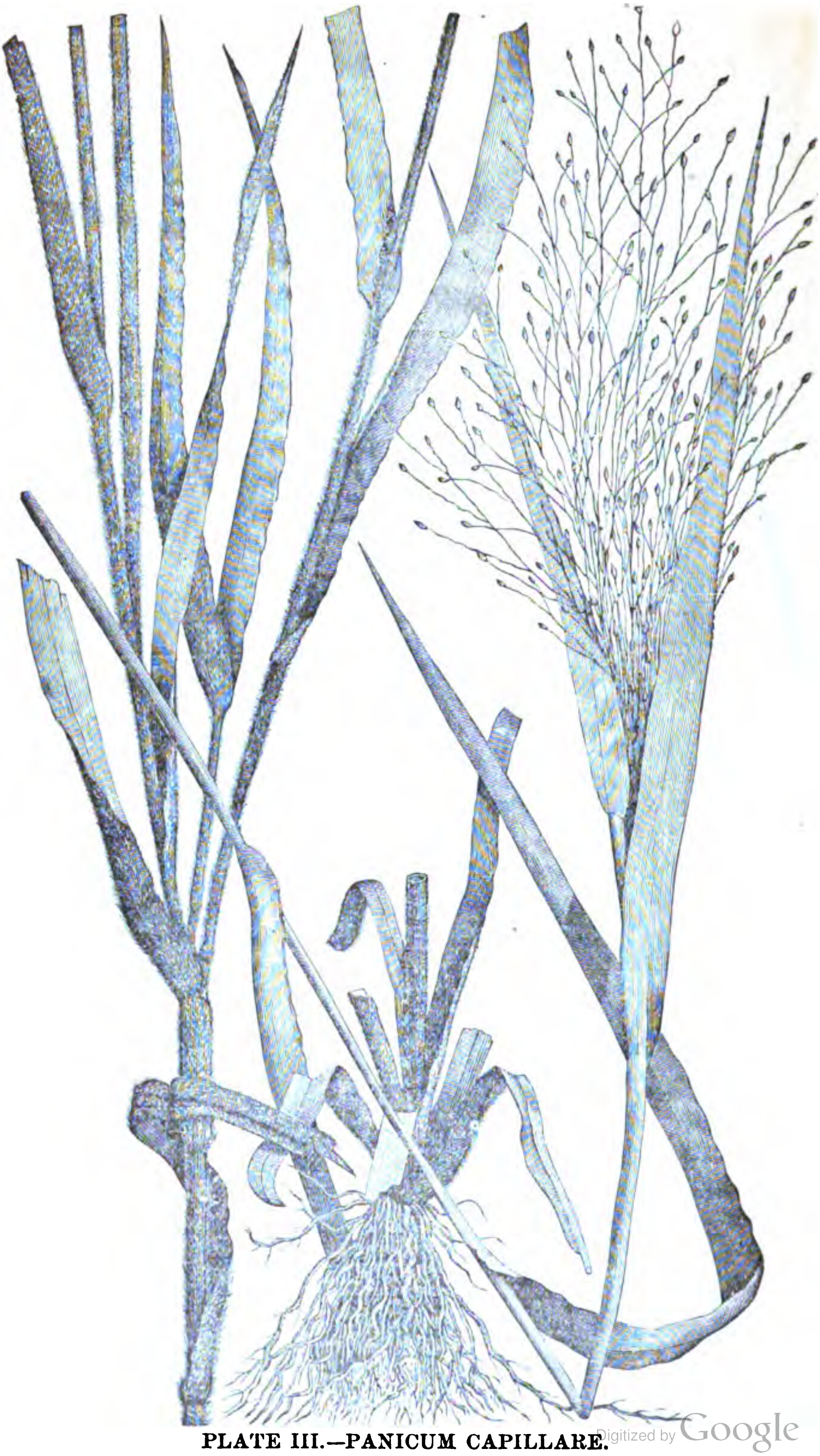

PLATE III.—PANICUM CAPILLARE.

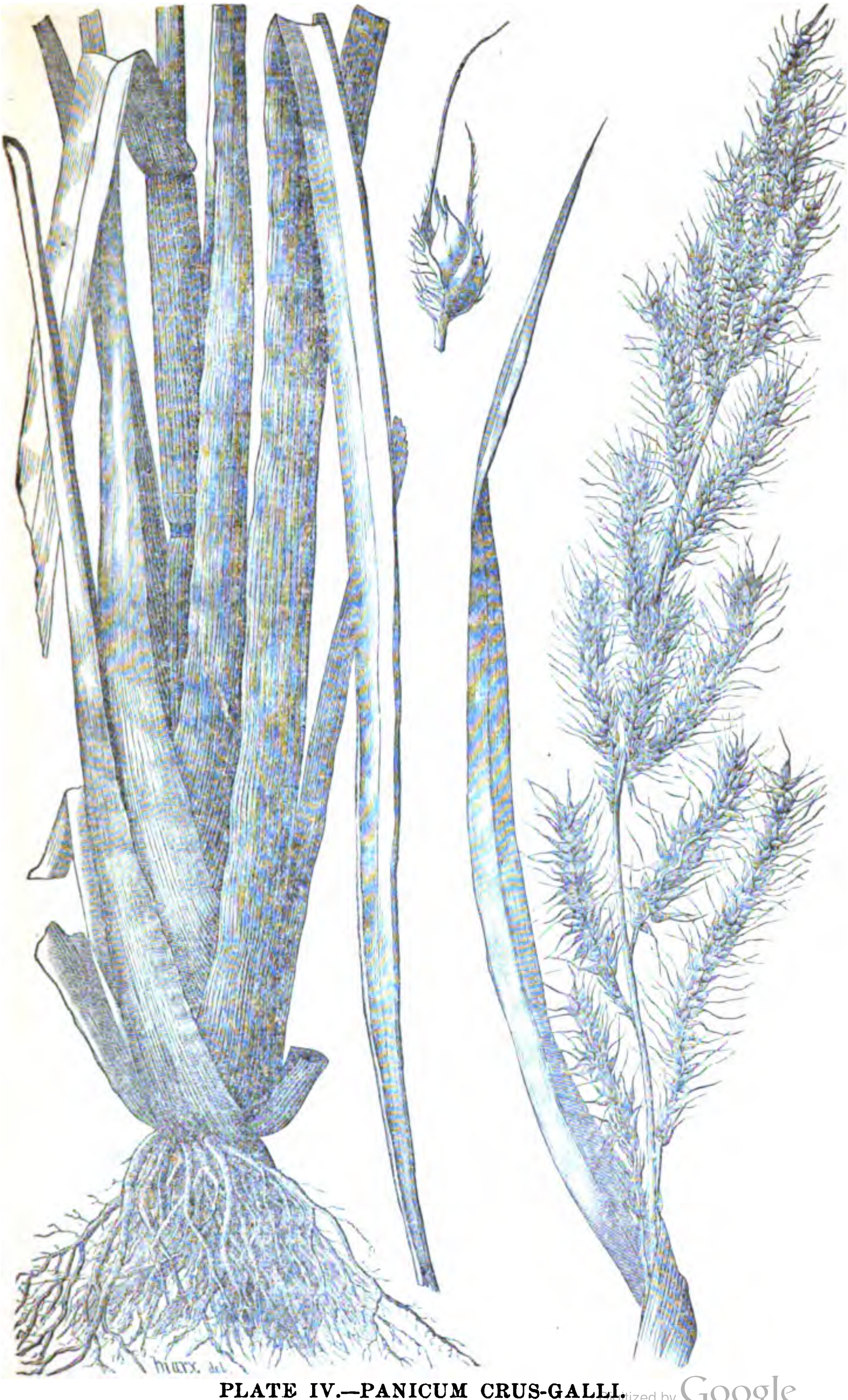

PLATE IV.—PANICUM CRUS-GALLI.

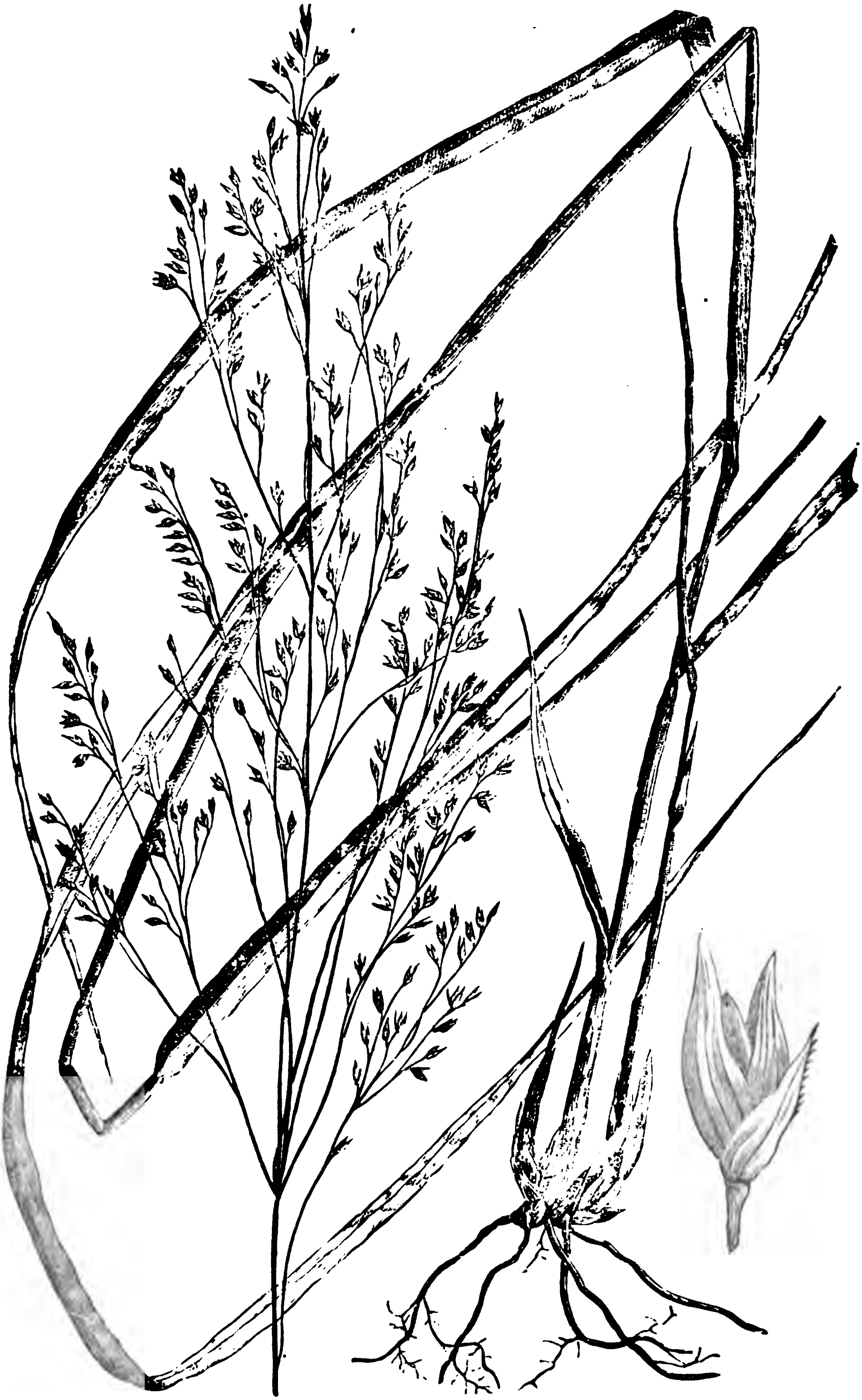

PLATE V.—PANICUM VIRGATUM.

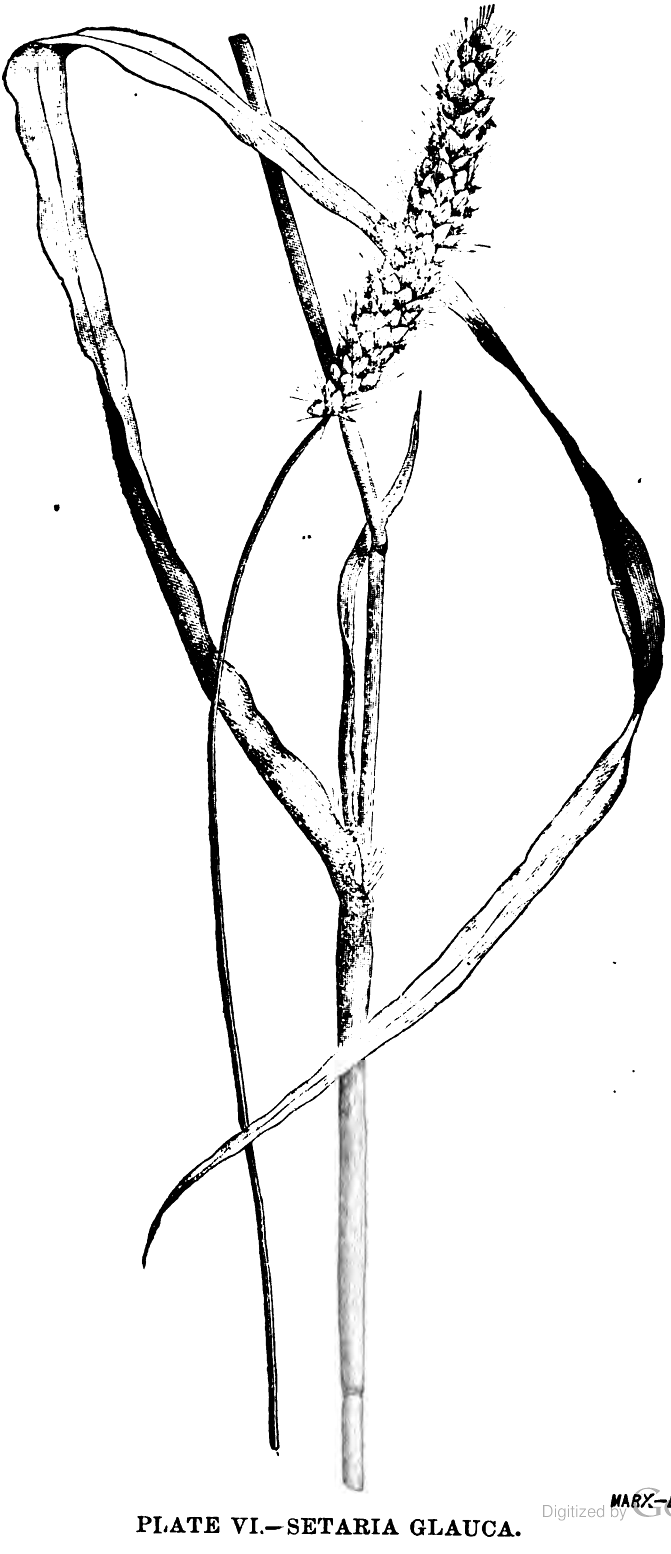

PLATE VI.—SETARIA GLAUCA.

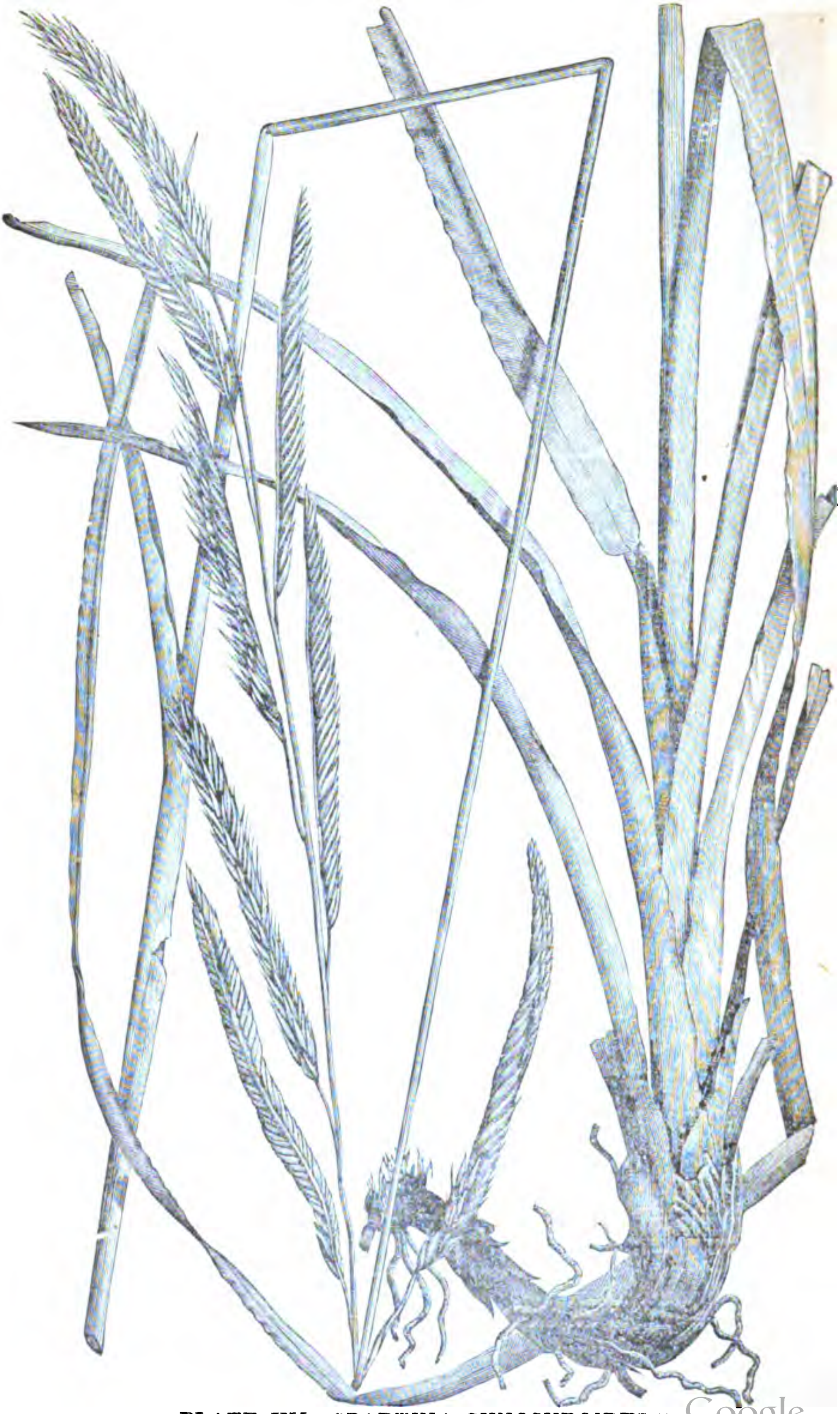

PLATE VII.—SPARTINA CYNOSUROIDES.

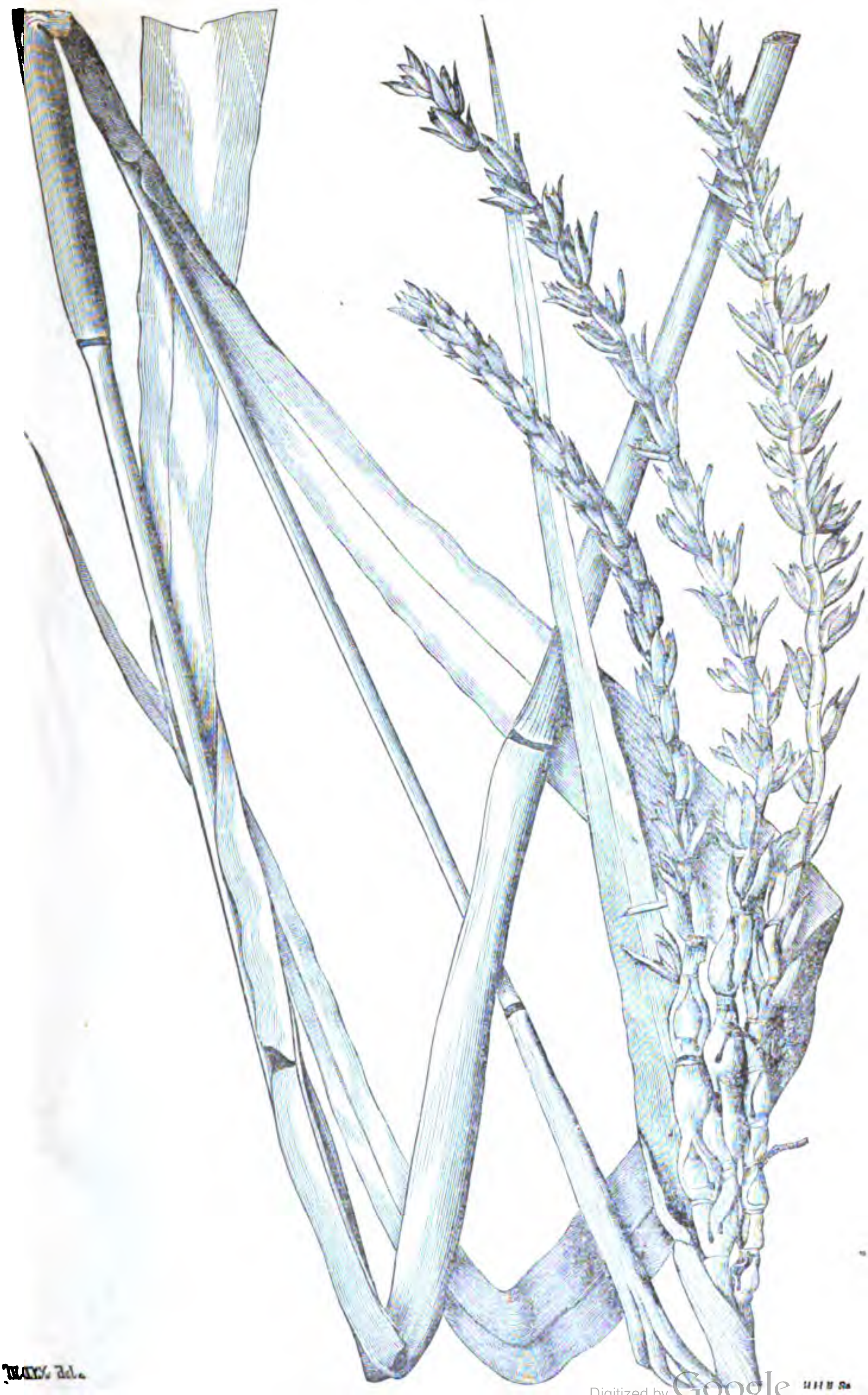

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PLATE VIII.—TRIPSACUM DACTYLOIDES.

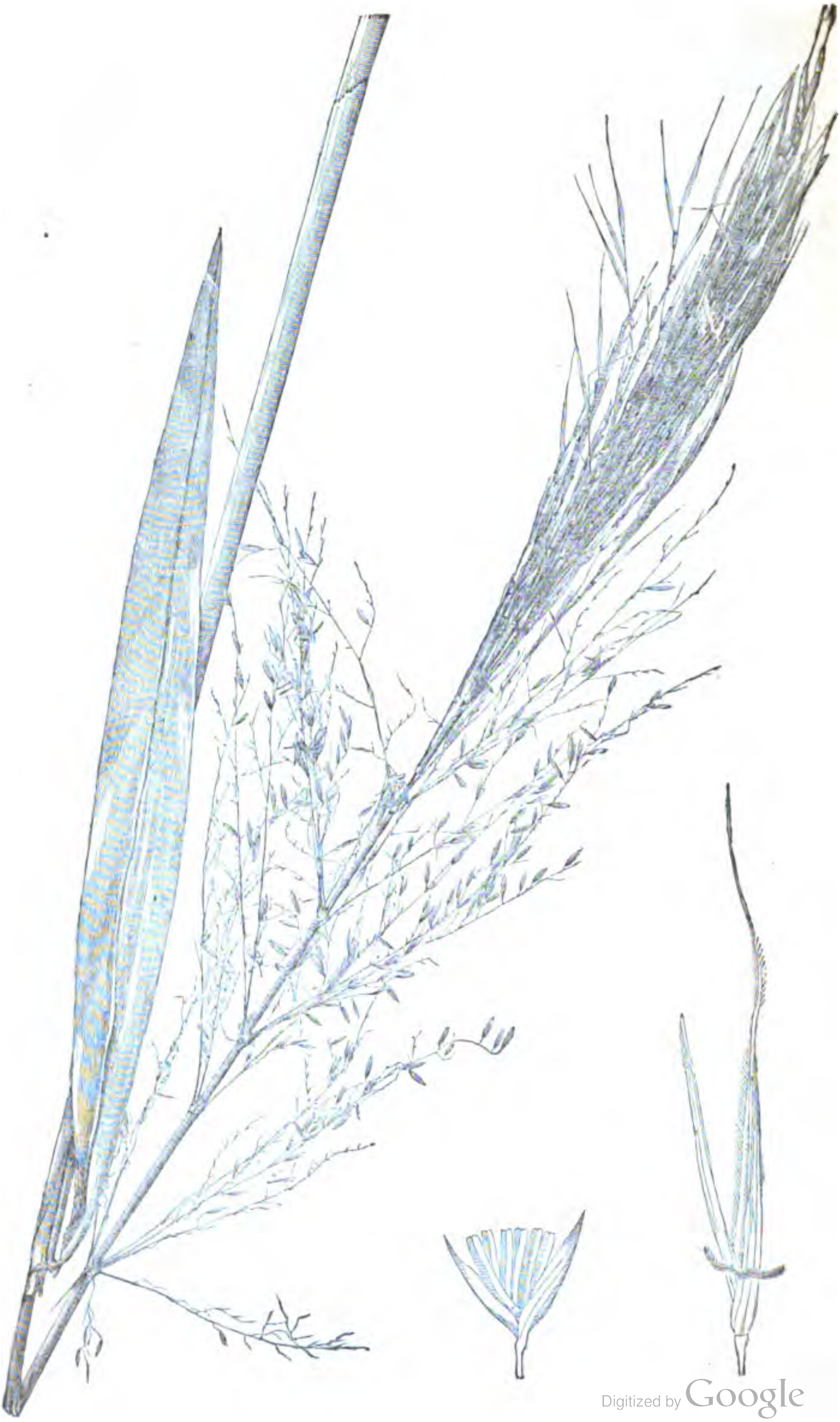


PLATE IX.—ZIZANIA AQUATICA.

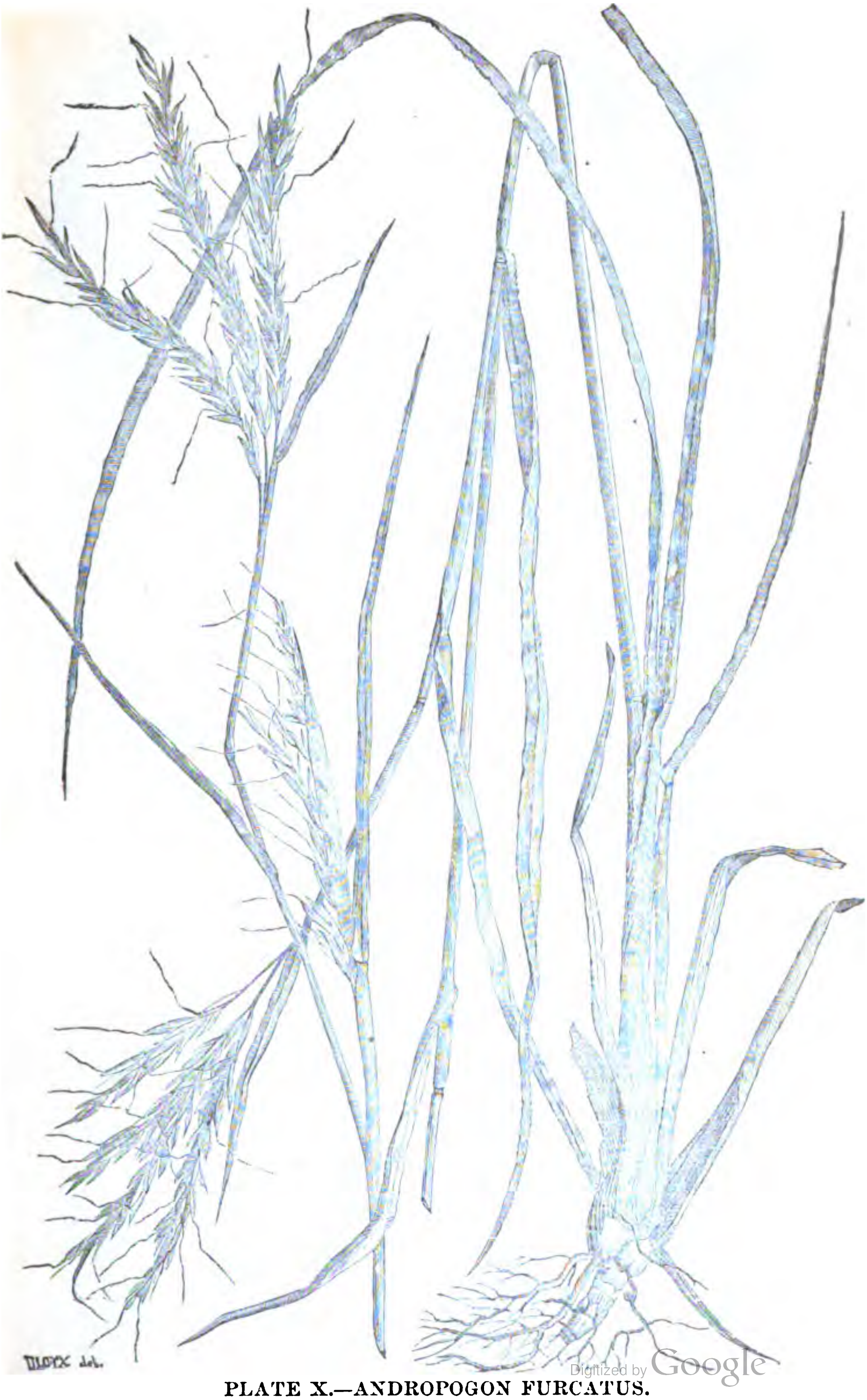


PLATE X.—ANDROPOGON FURCATUS.

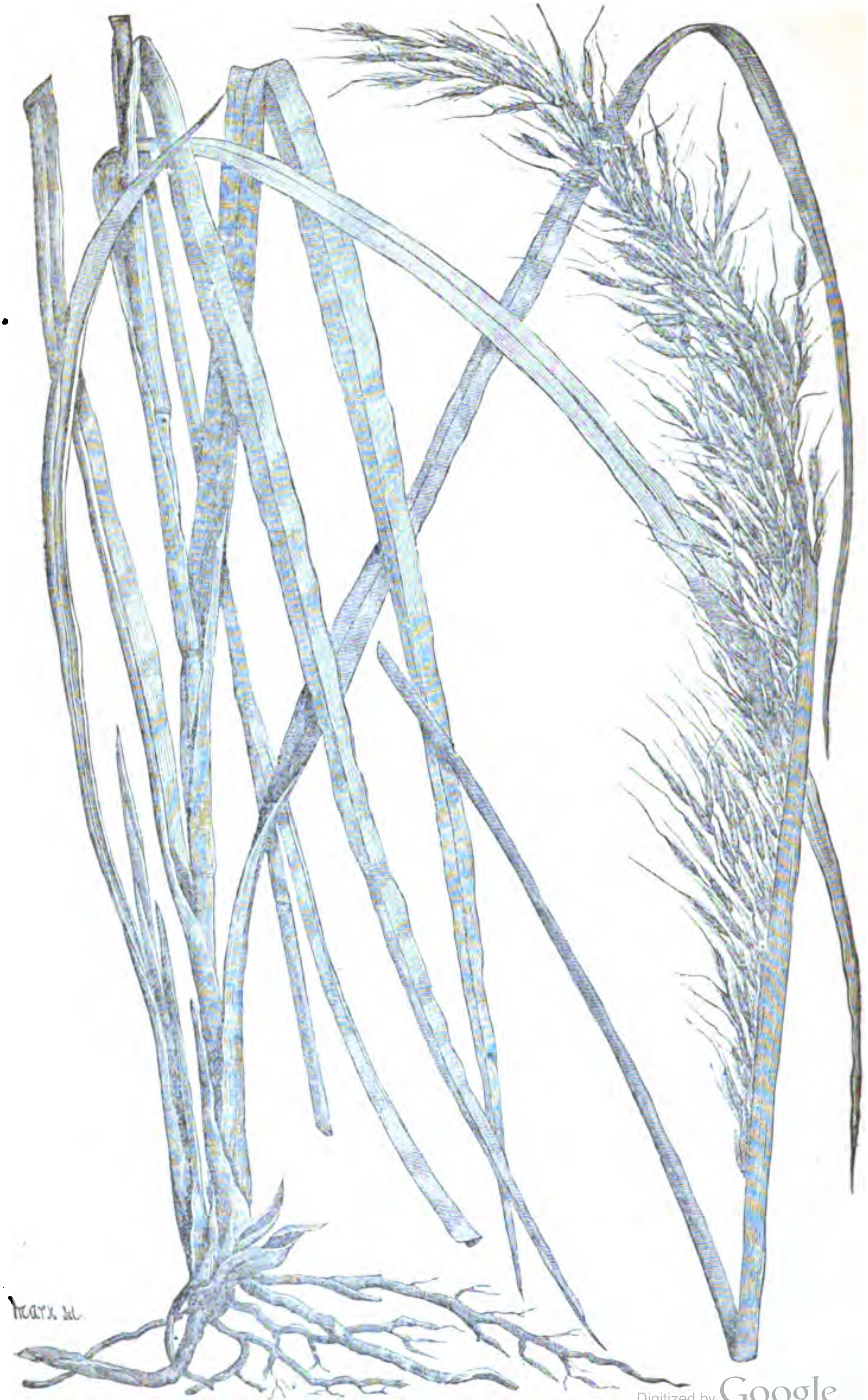


PLATE XI.—CHRYSOPOGON NUTANS.

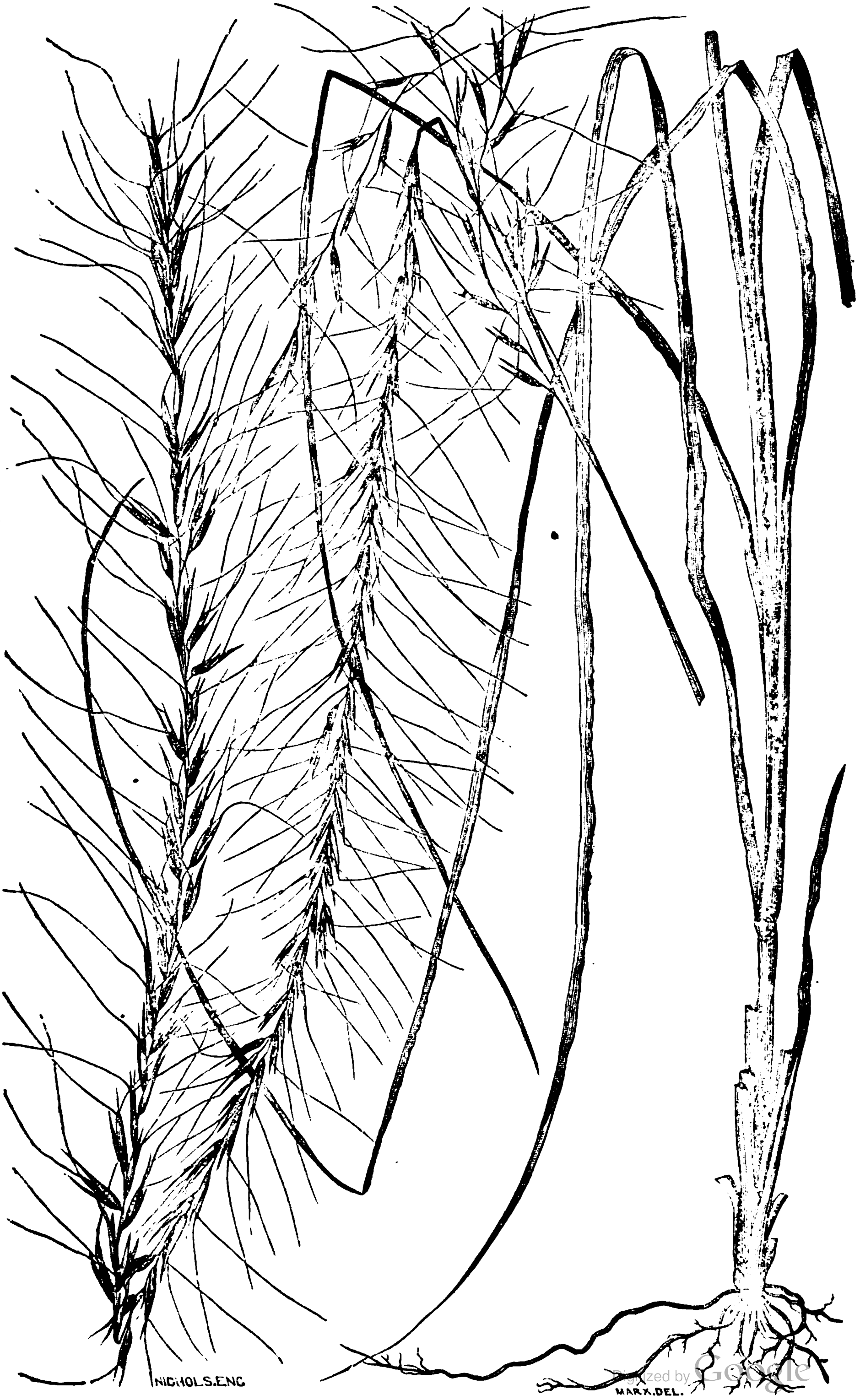


PLATE XII.—ARISTIDA PURPURASCENS.

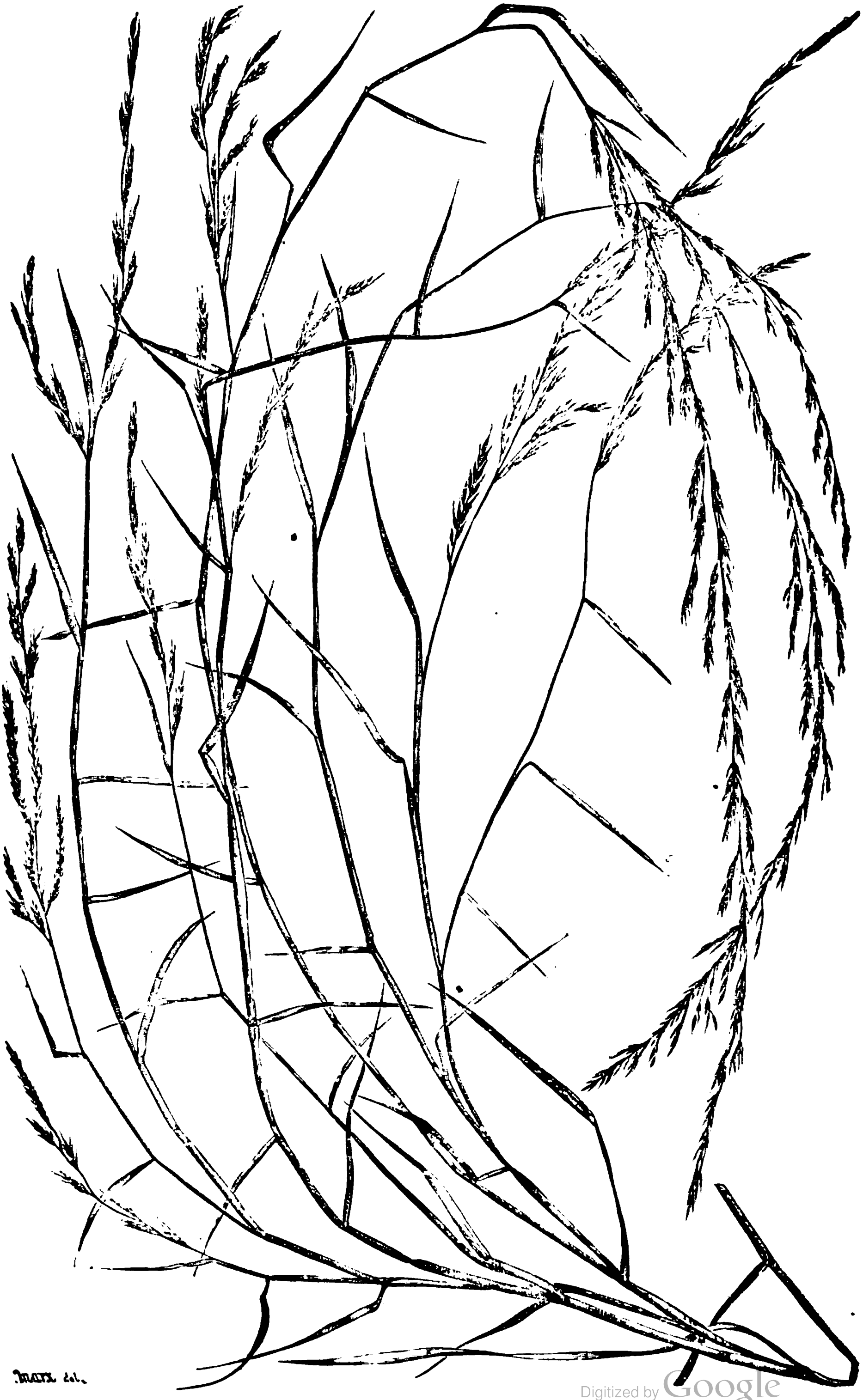


PLATE XIII.—MUHLENBERGIA DIFFUSA.

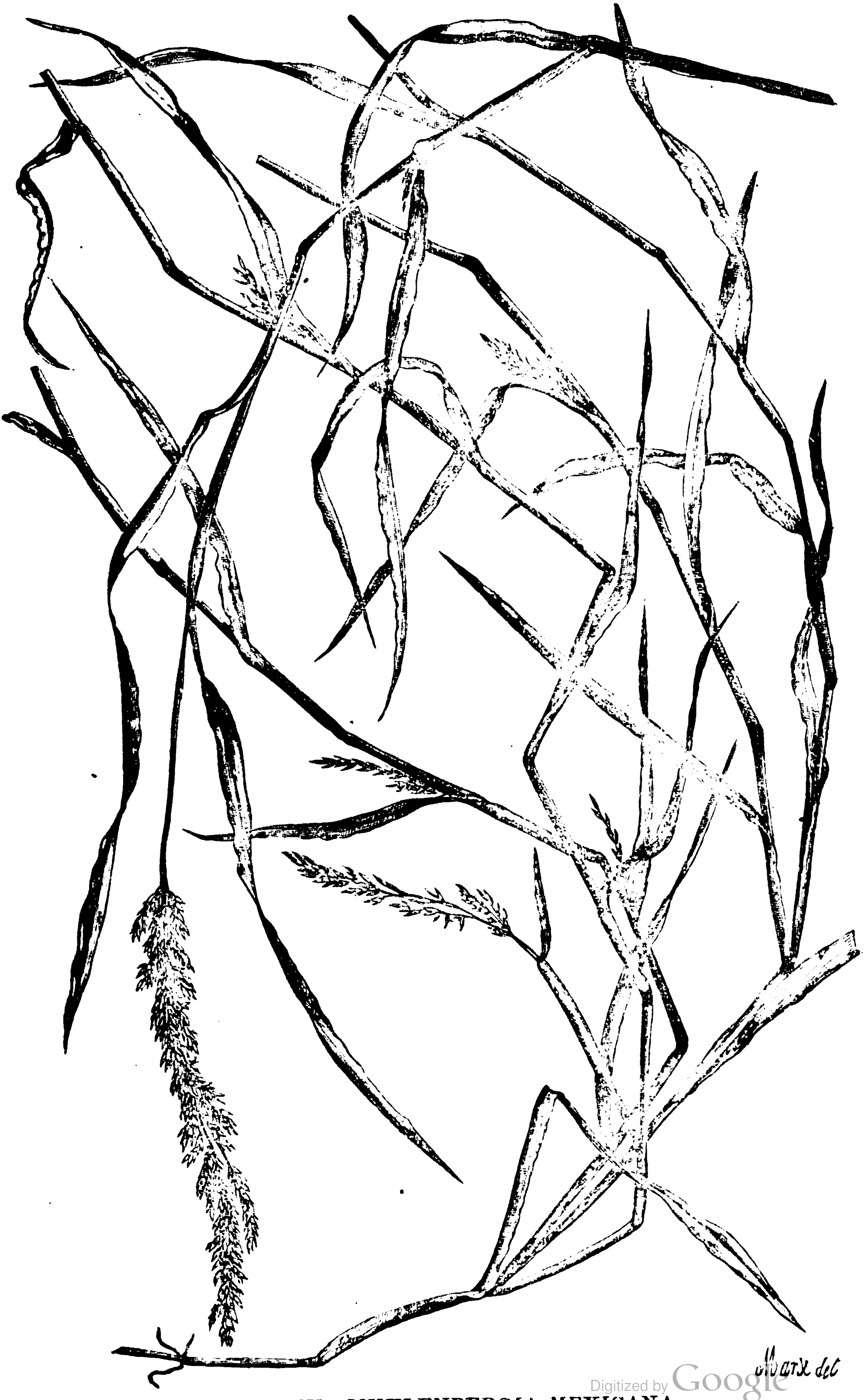


PLATE XIV.—MUHLENBERGIA MEXICANA.

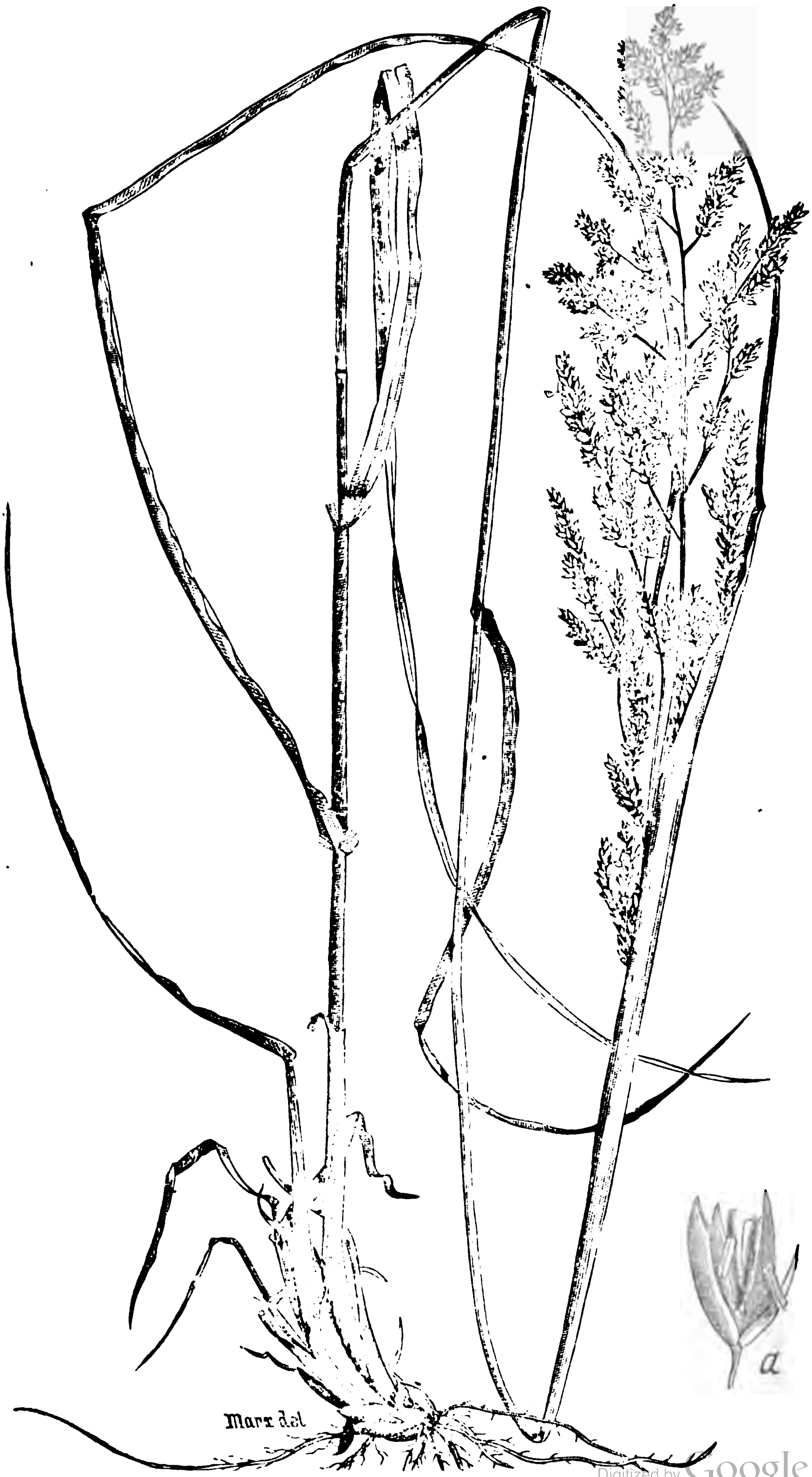


PLATE XV.—SPOROBOLUS CRYPTANDRUS.

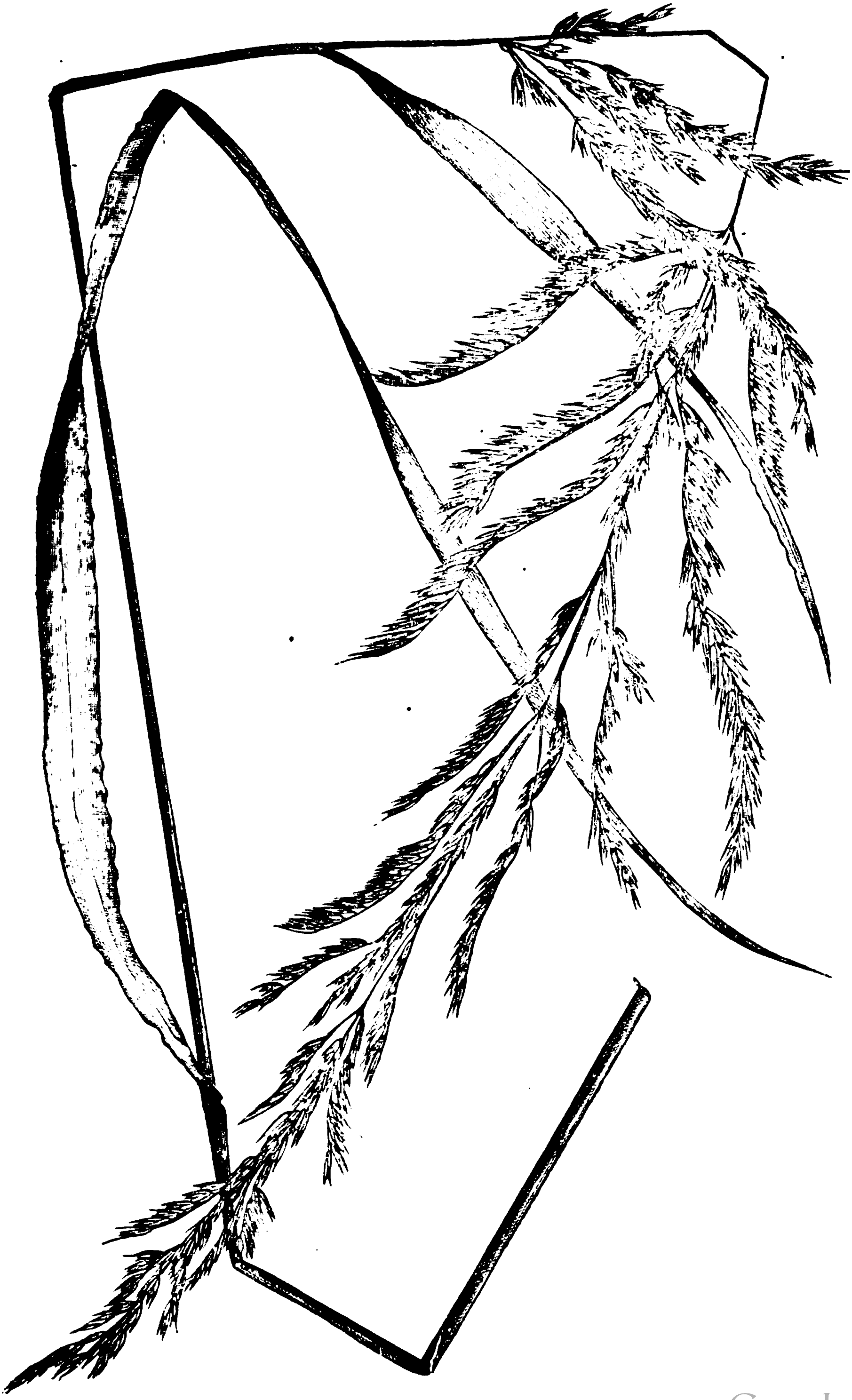
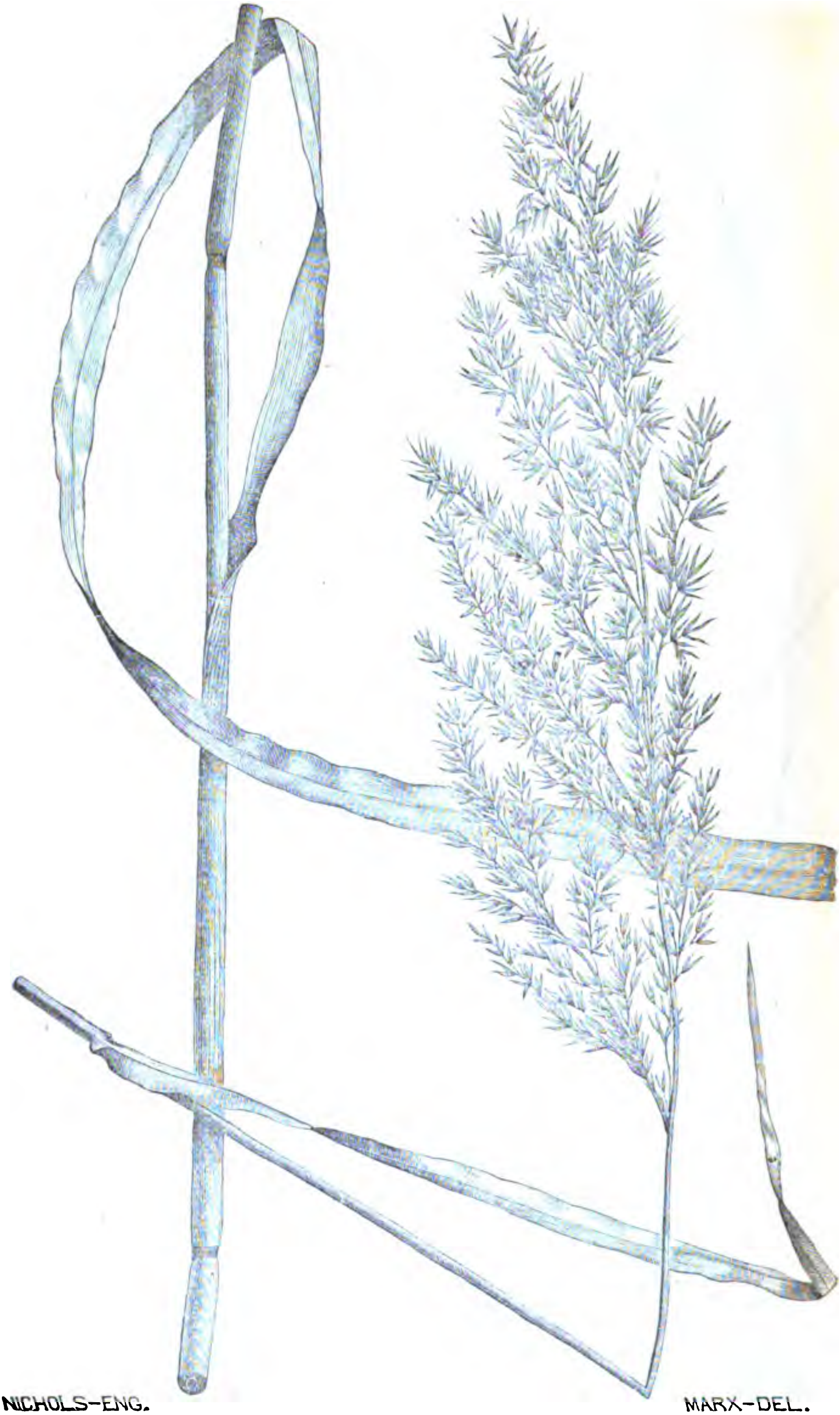


PLATE XVI.—CINNA ARUNDINACEA.



NICHOLS-ENG. MARX-DEL.

PLATE XVII.—DEYEUXIA CANADENSIS.

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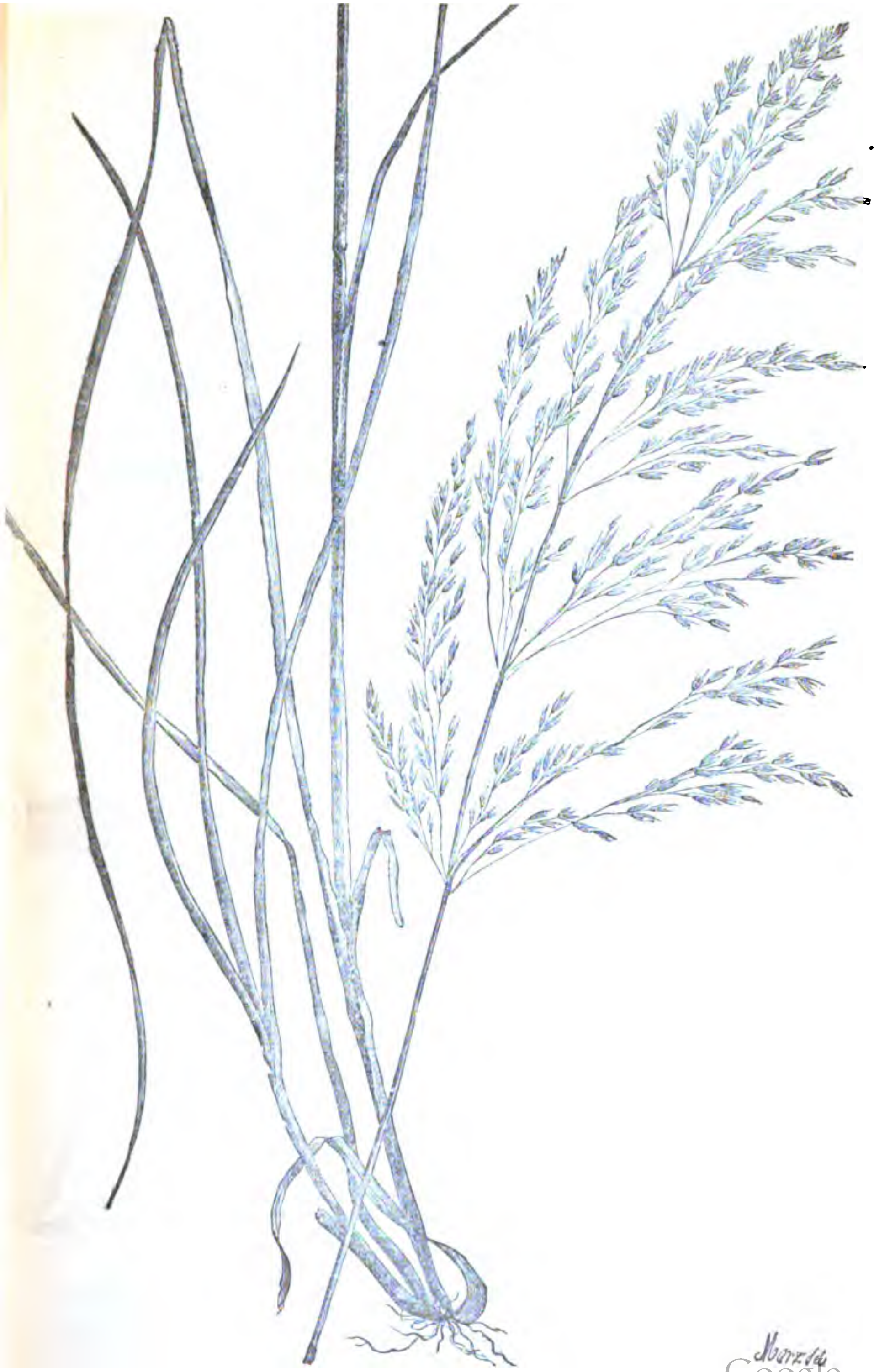

PLATE XVIII.—DESCHAMPSIA CÆSPITOSA.

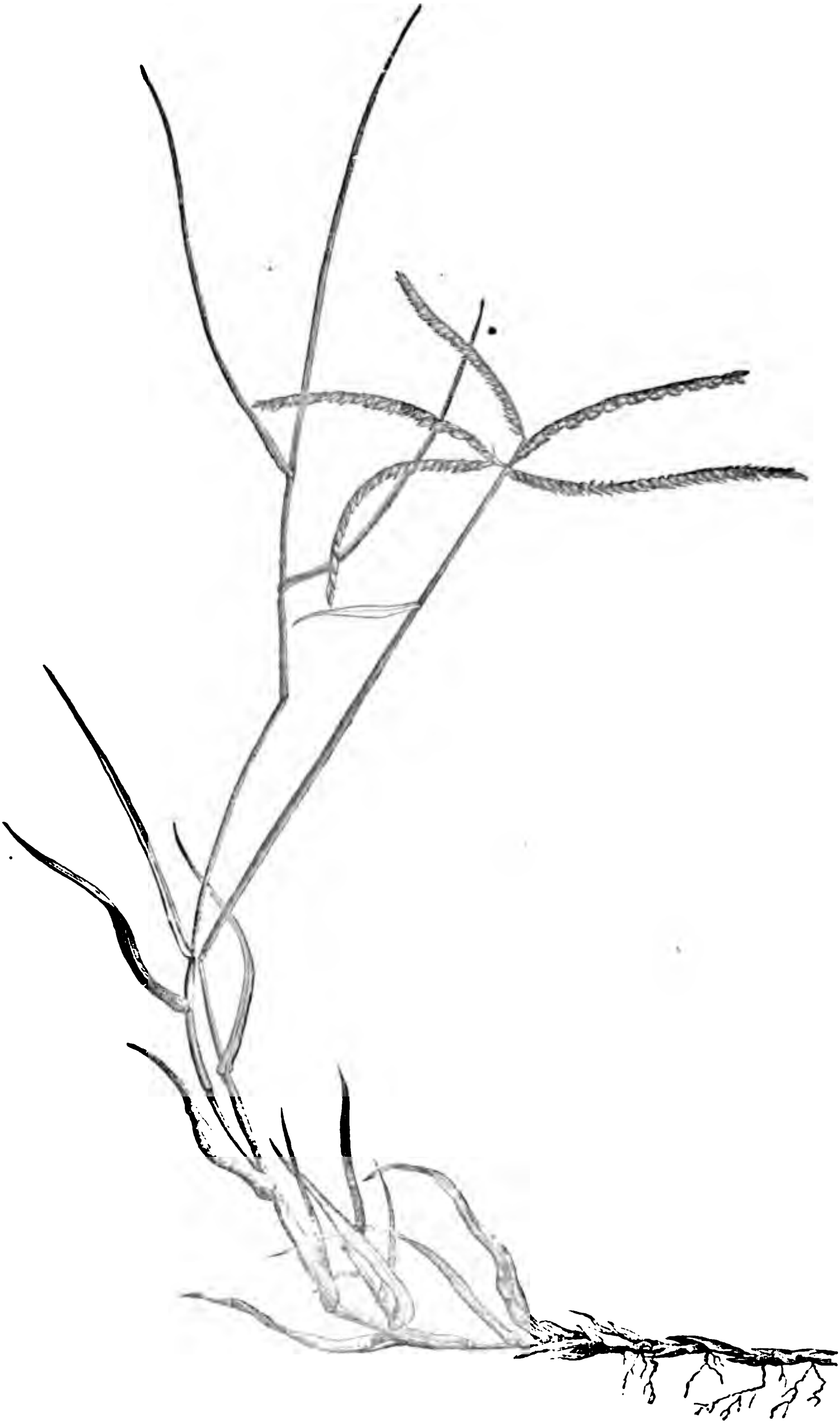

PLATE XIX.—CYNODON DACTYLON.

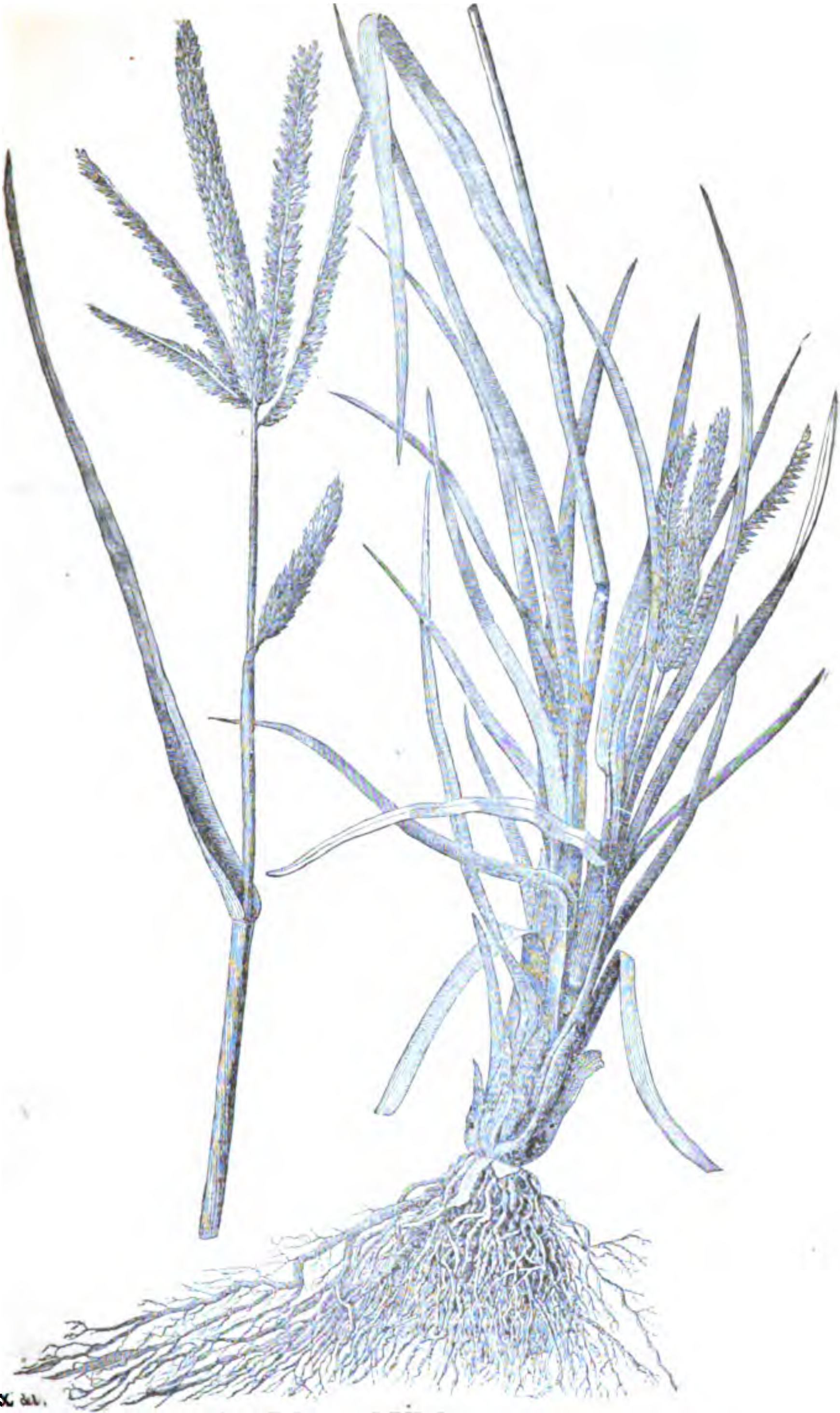

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PLATE XX.—ELEUSINE INDICA.

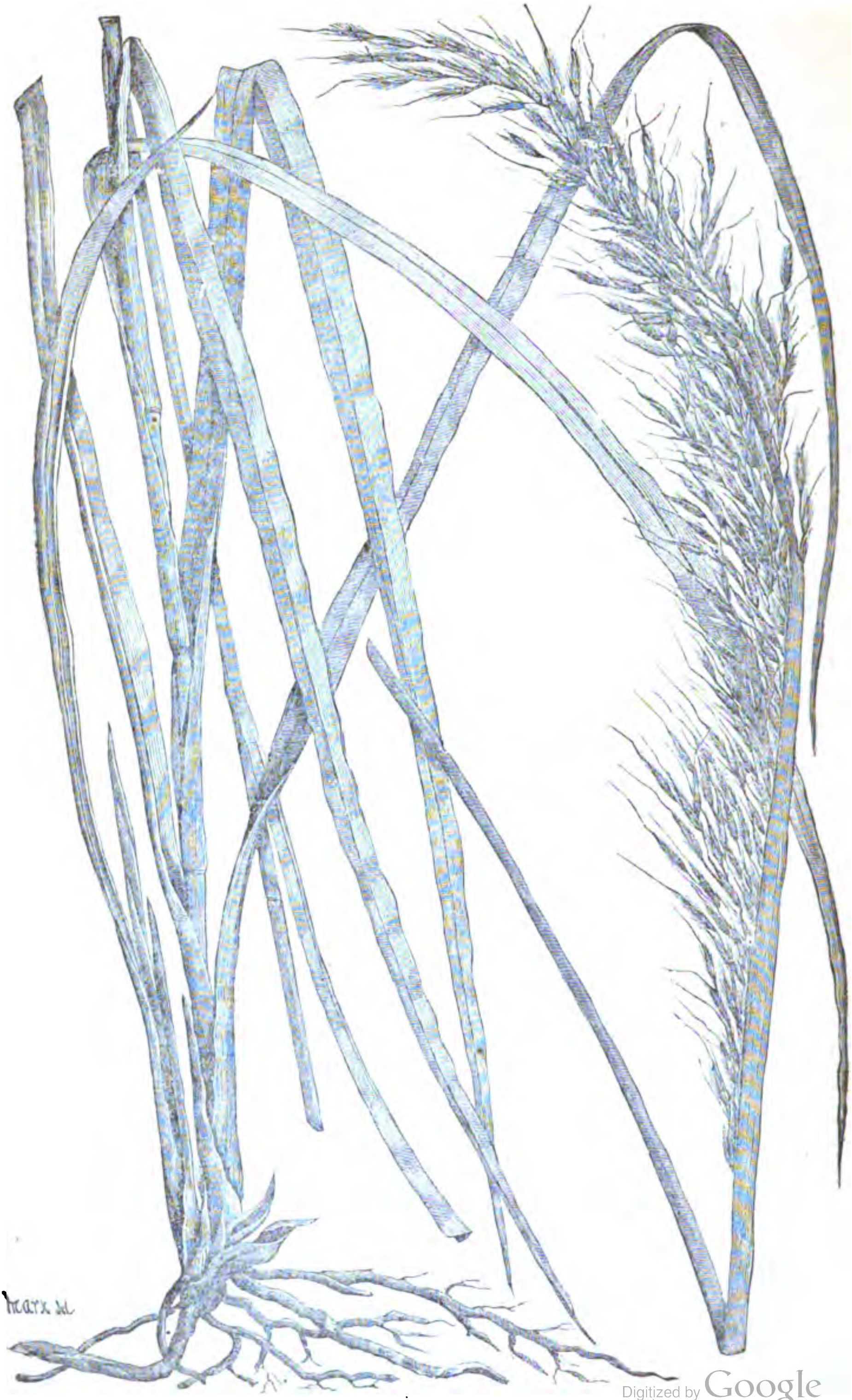


PLATE XI.—CHRYSOPOGON NUTANS.

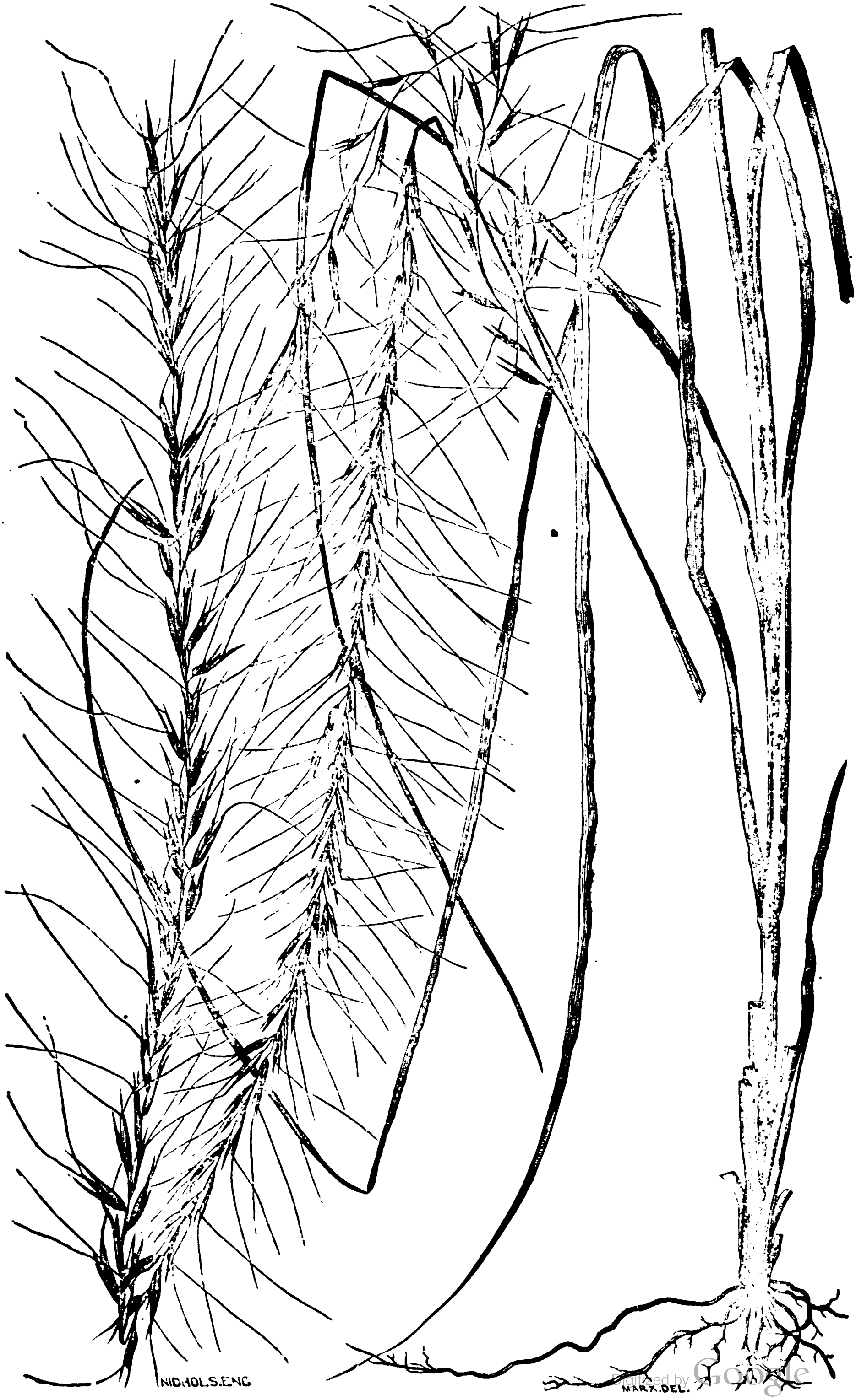


PLATE XII.—ARISTIDA PURPURASCENS.

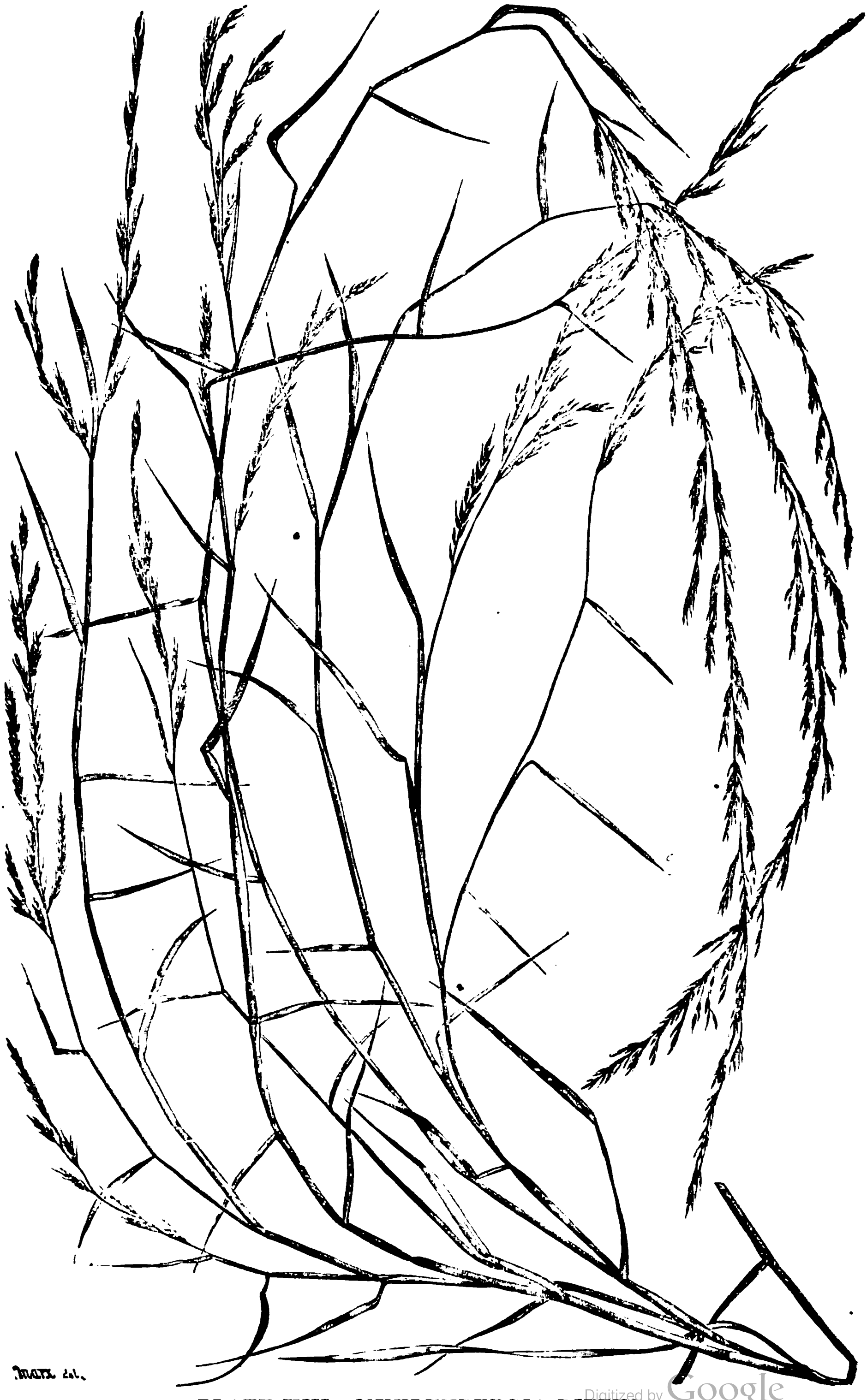


PLATE XIII.—MUHLENBERGIA DIFFUSA.

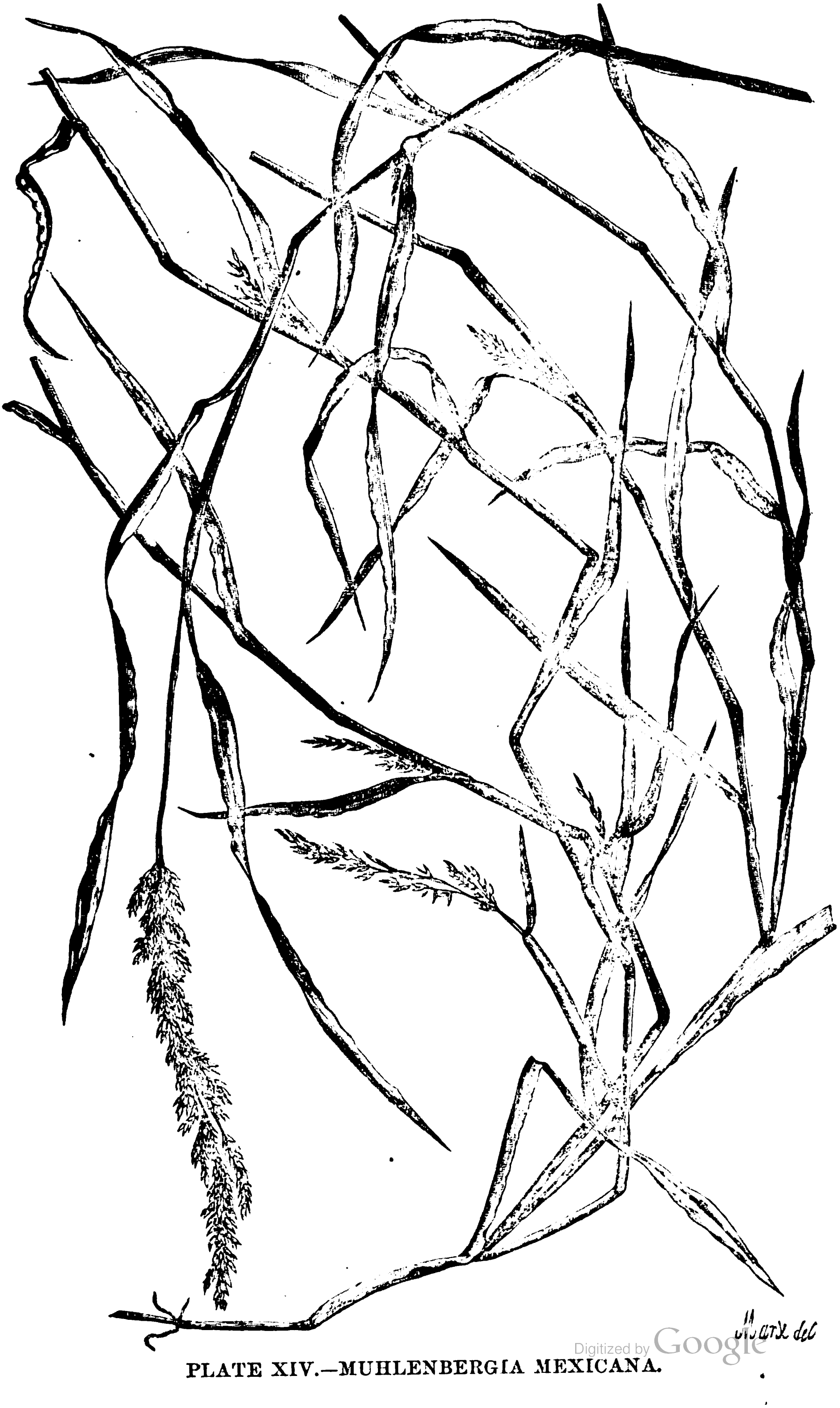


PLATE XIV.—MUHLENBERGIA MEXICANA.

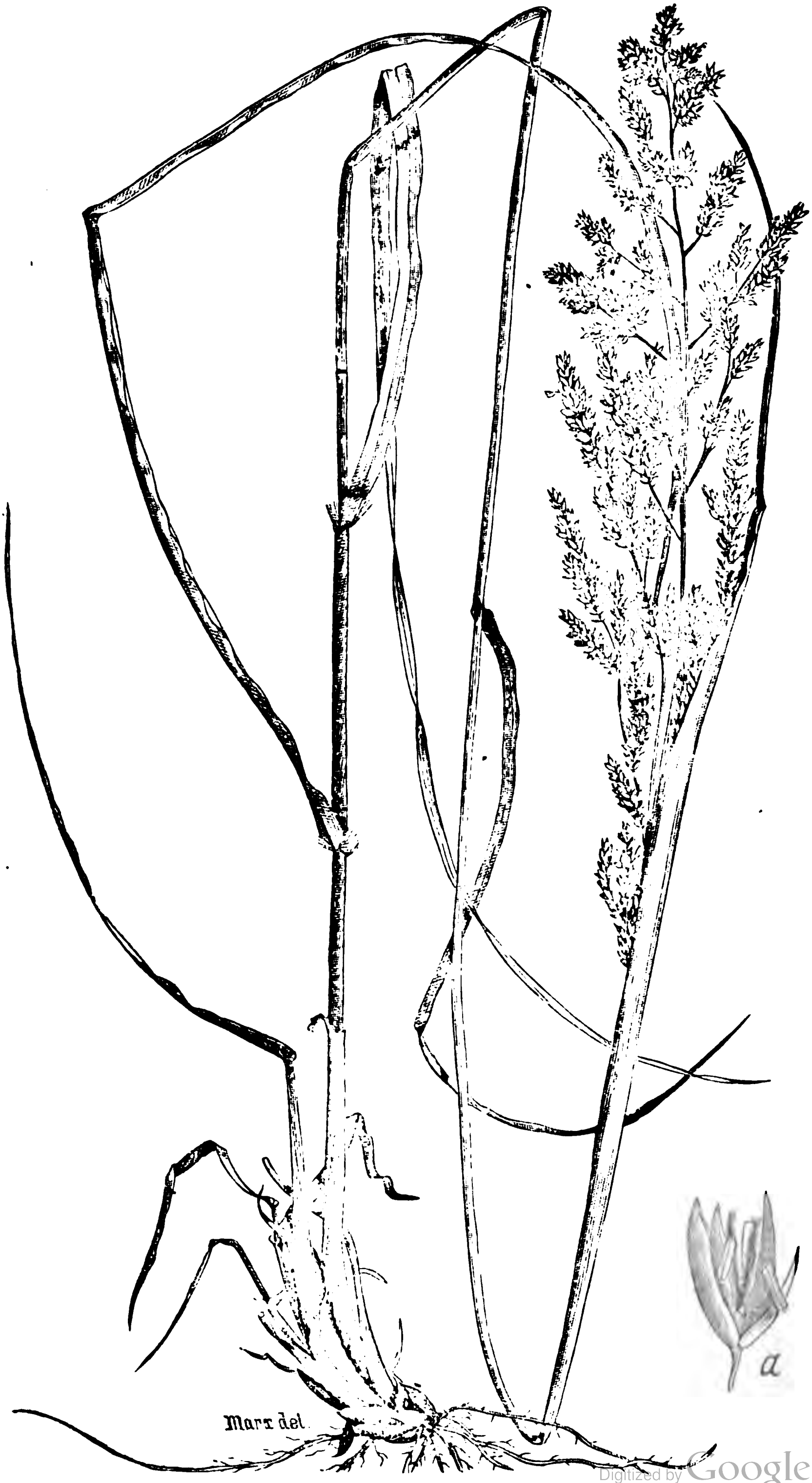


PLATE XV.—SPOROBOLUS CRYPTANDRUS.

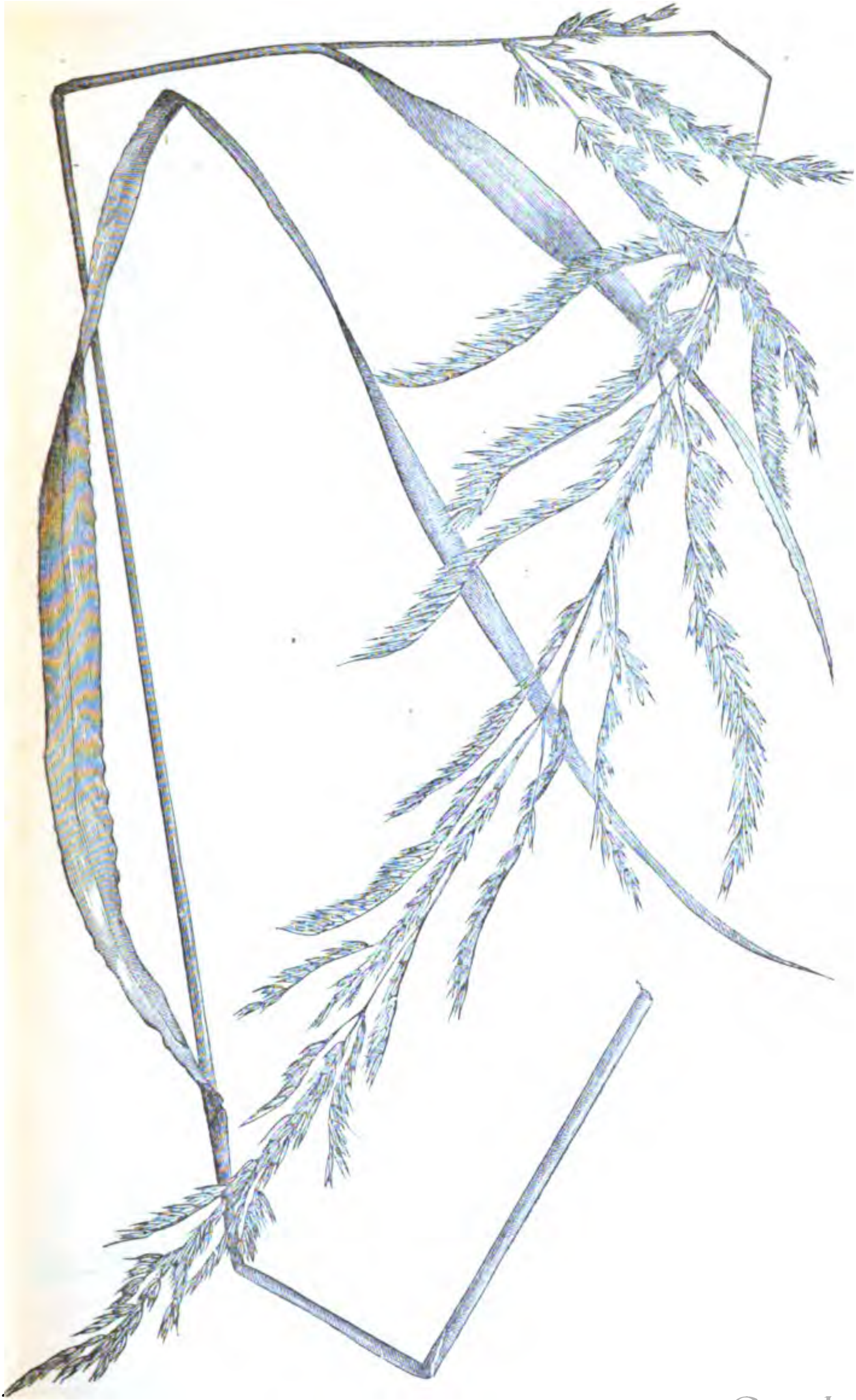
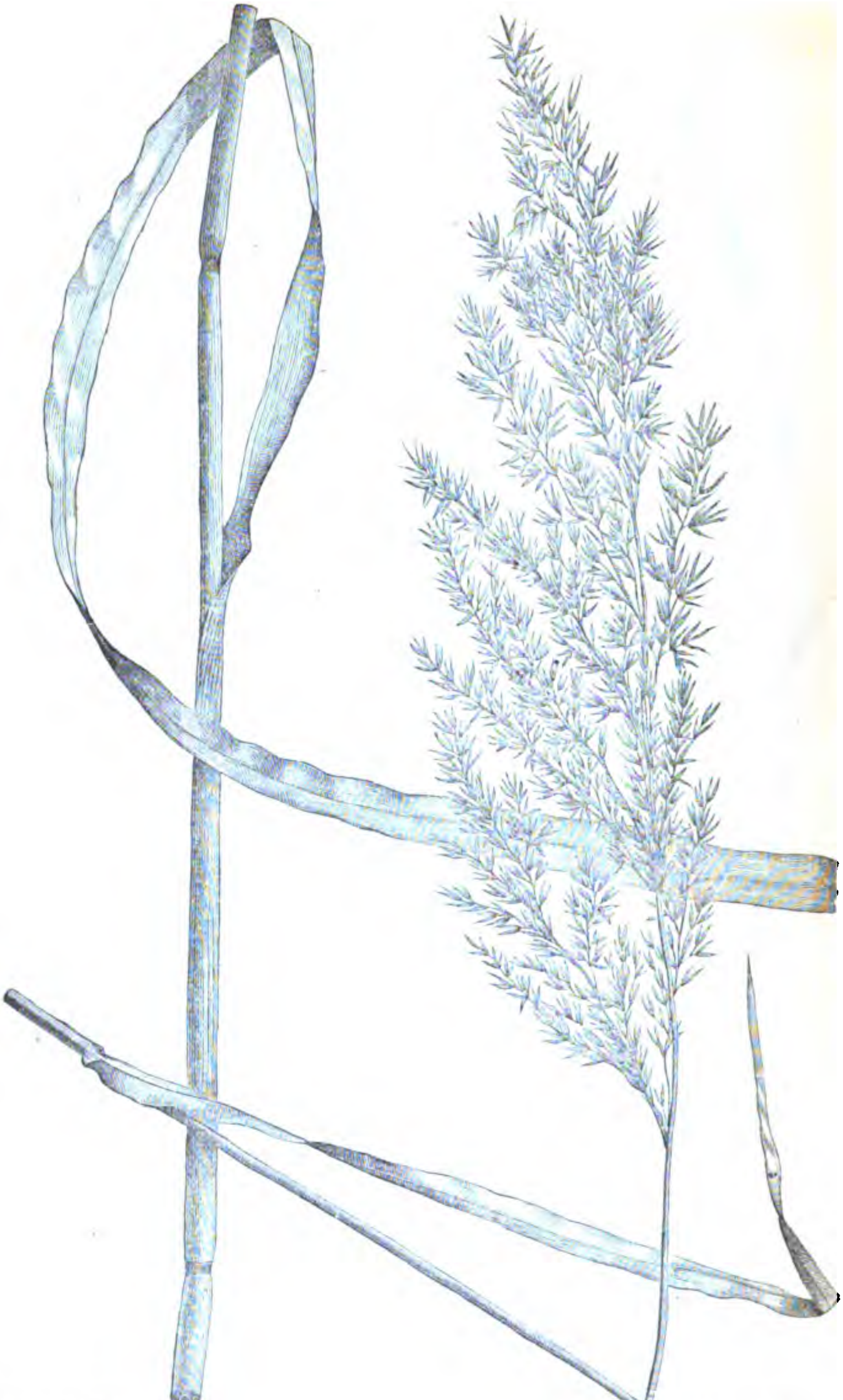


PLATE XVI.—CINNA ARUNDINACEA.



NICHOLS-ENG. MARX-DEL.

PLATE XVII.—DEYEUXIA CANADENSIS.

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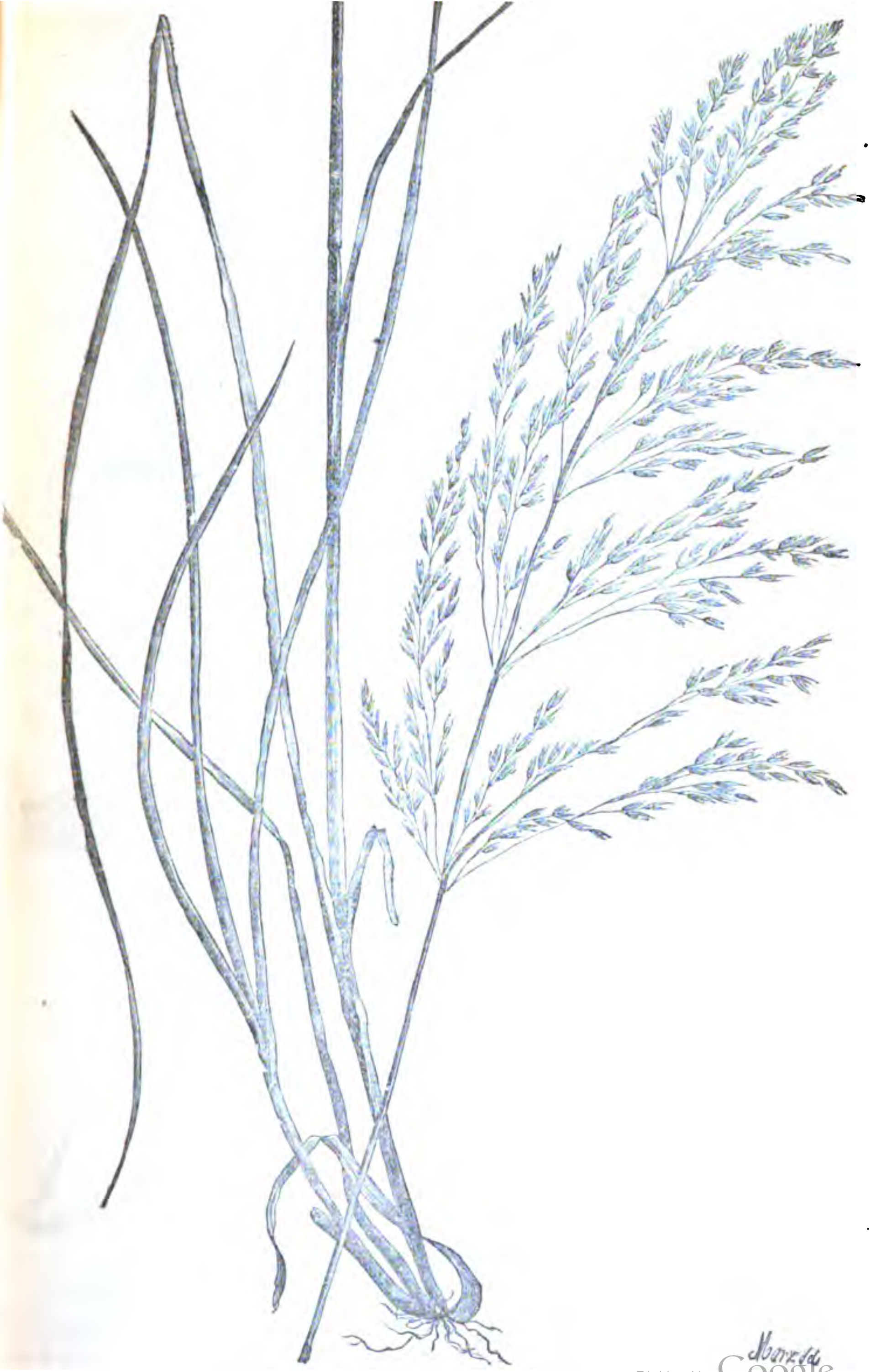

PLATE XVIII.—DESCHAMPSIA CÆSPITOSA.

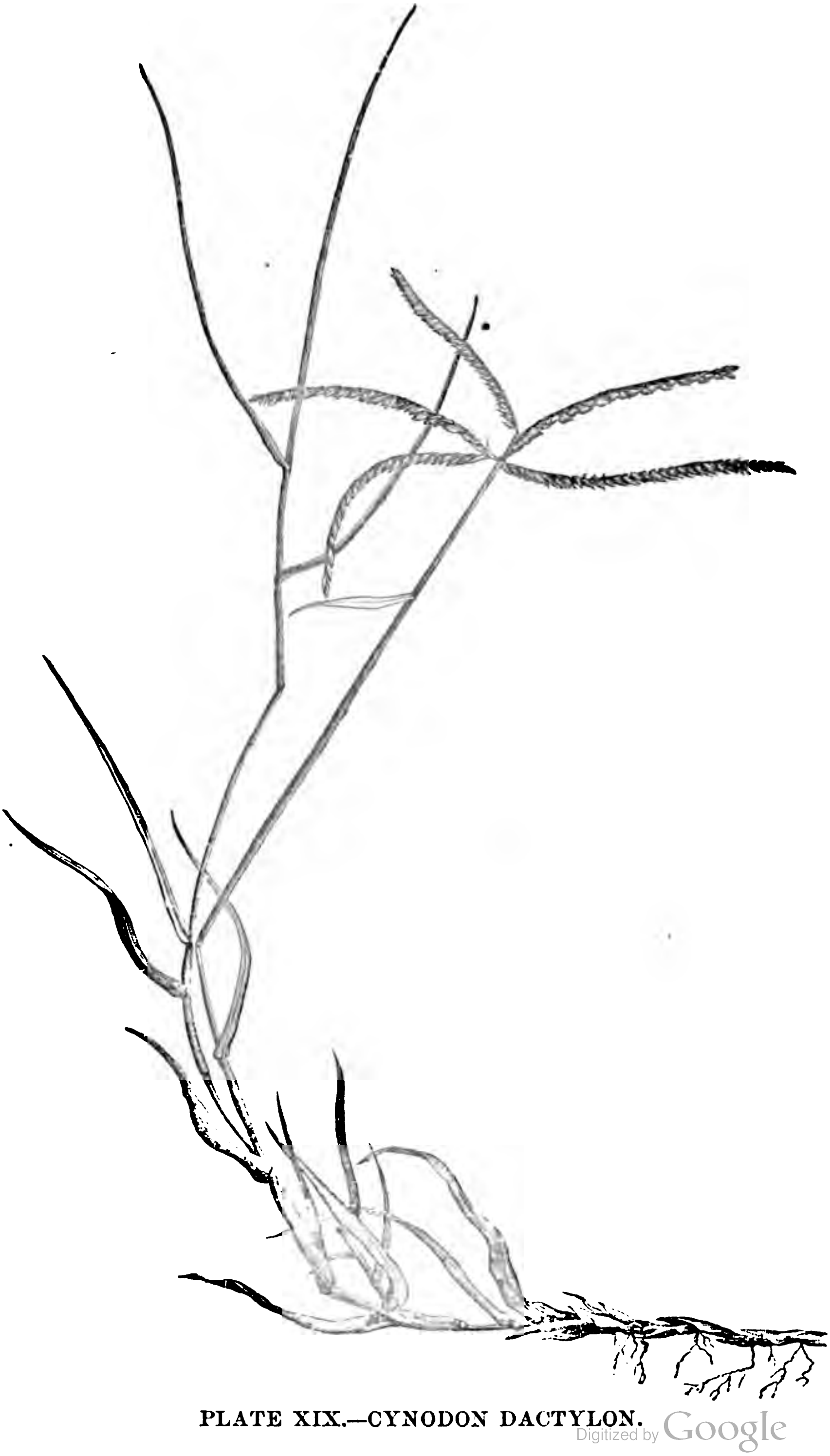

PLATE XIX.—CYNODON DACTYLON.

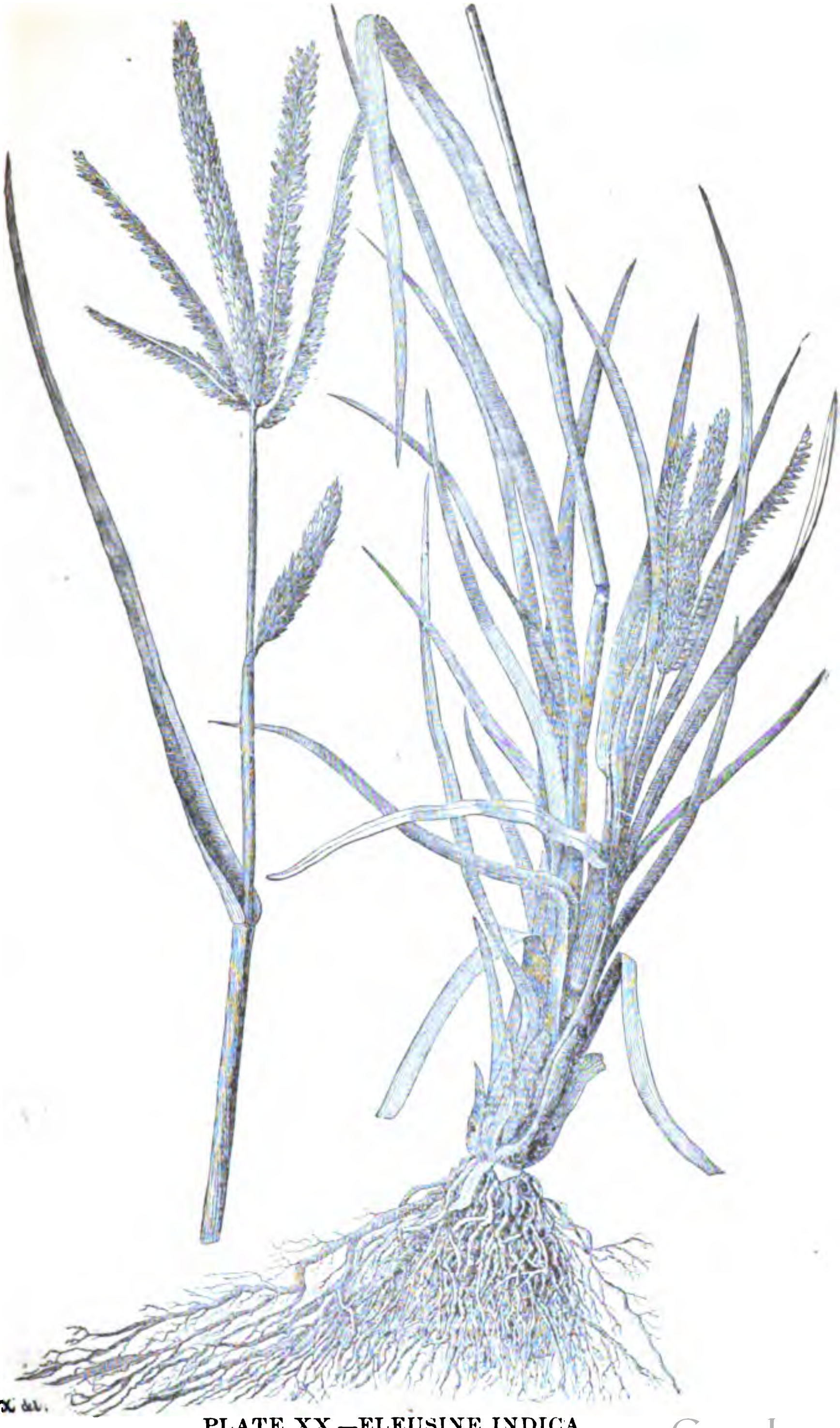

PLATE XX.—ELEUSINE INDICA.

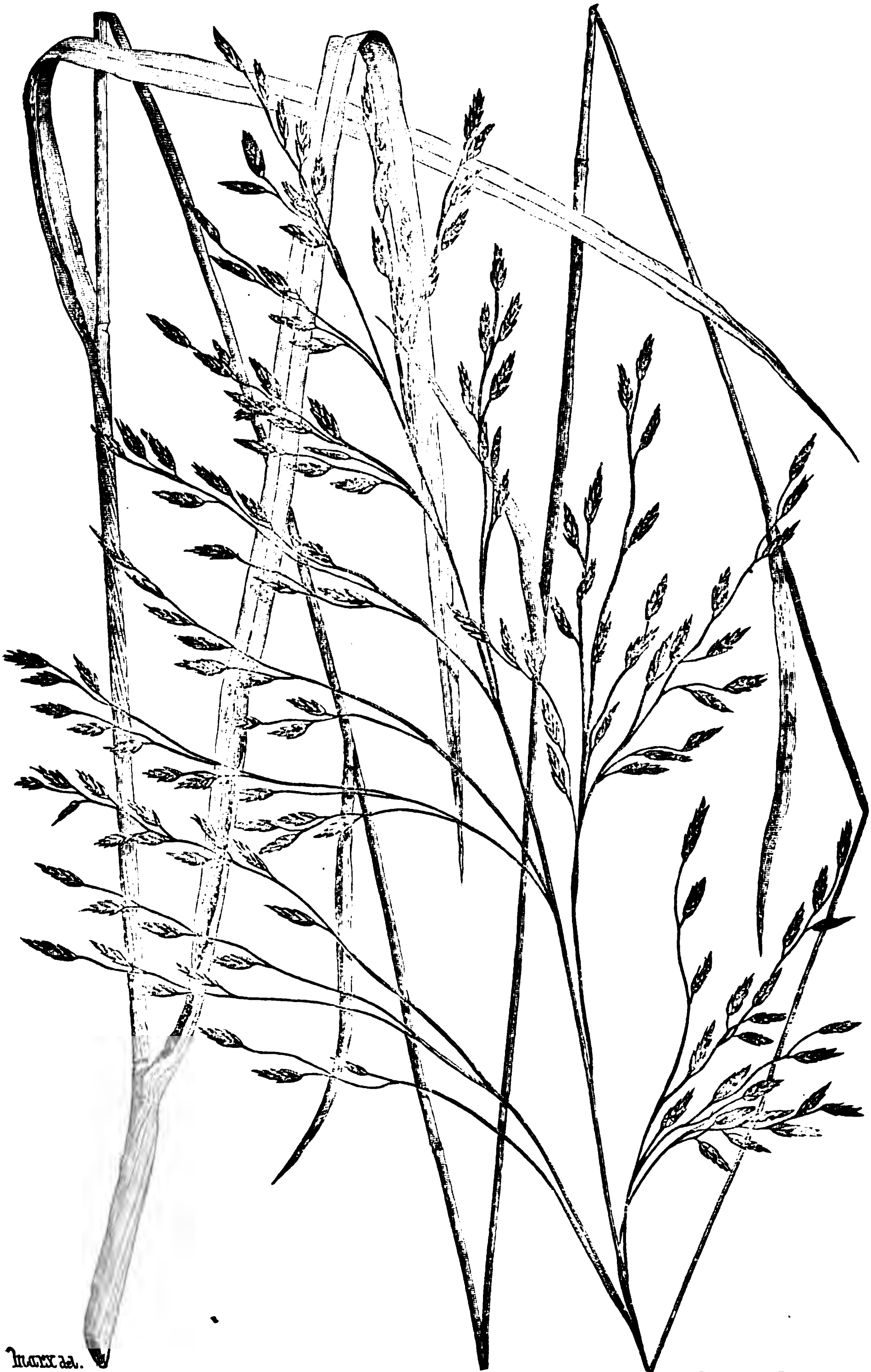

PLATE XXI.—TRIODIA SESLERIODIS.

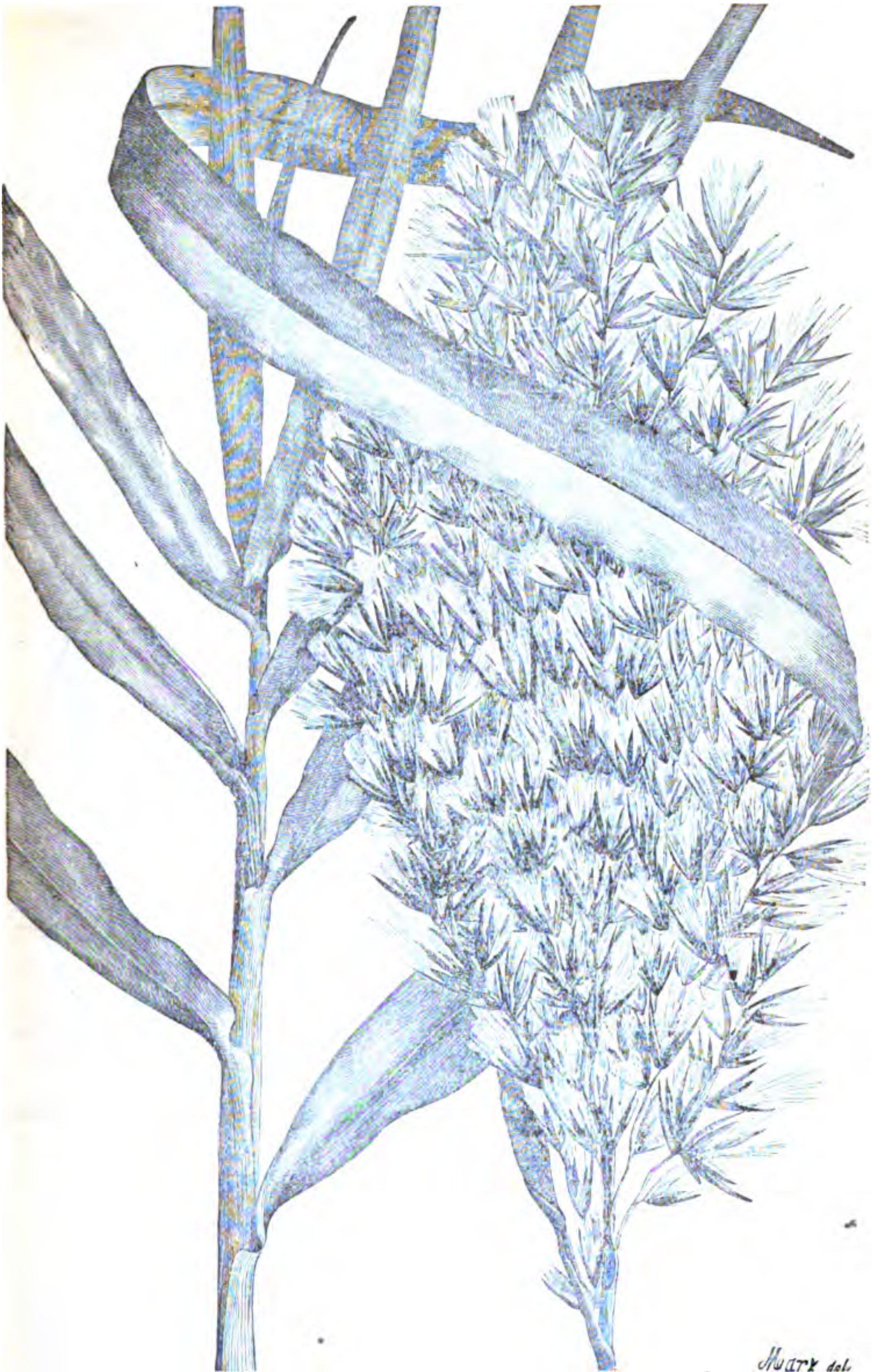

PLATE XXII.—PHRAGMITES COMMUNIS.

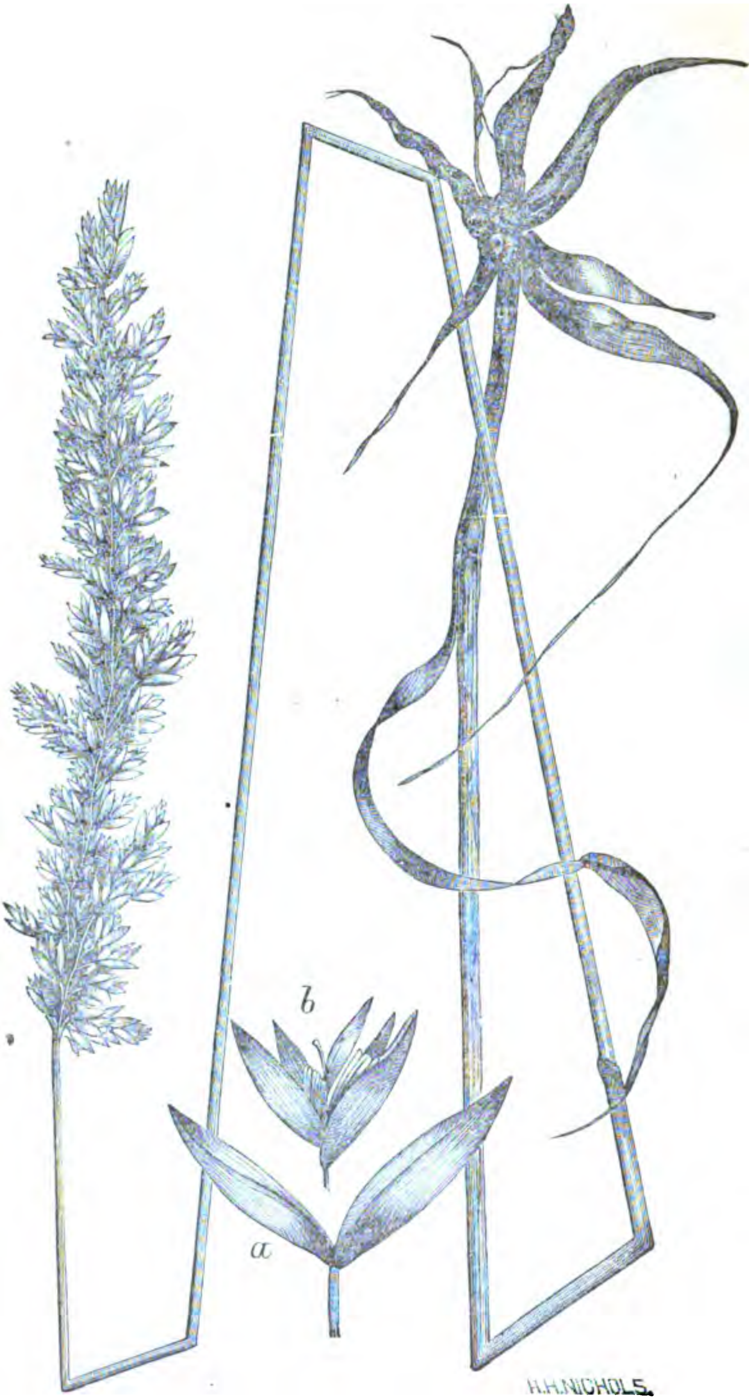
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PLATE XXIII.—KOELERIA CRISTATA.

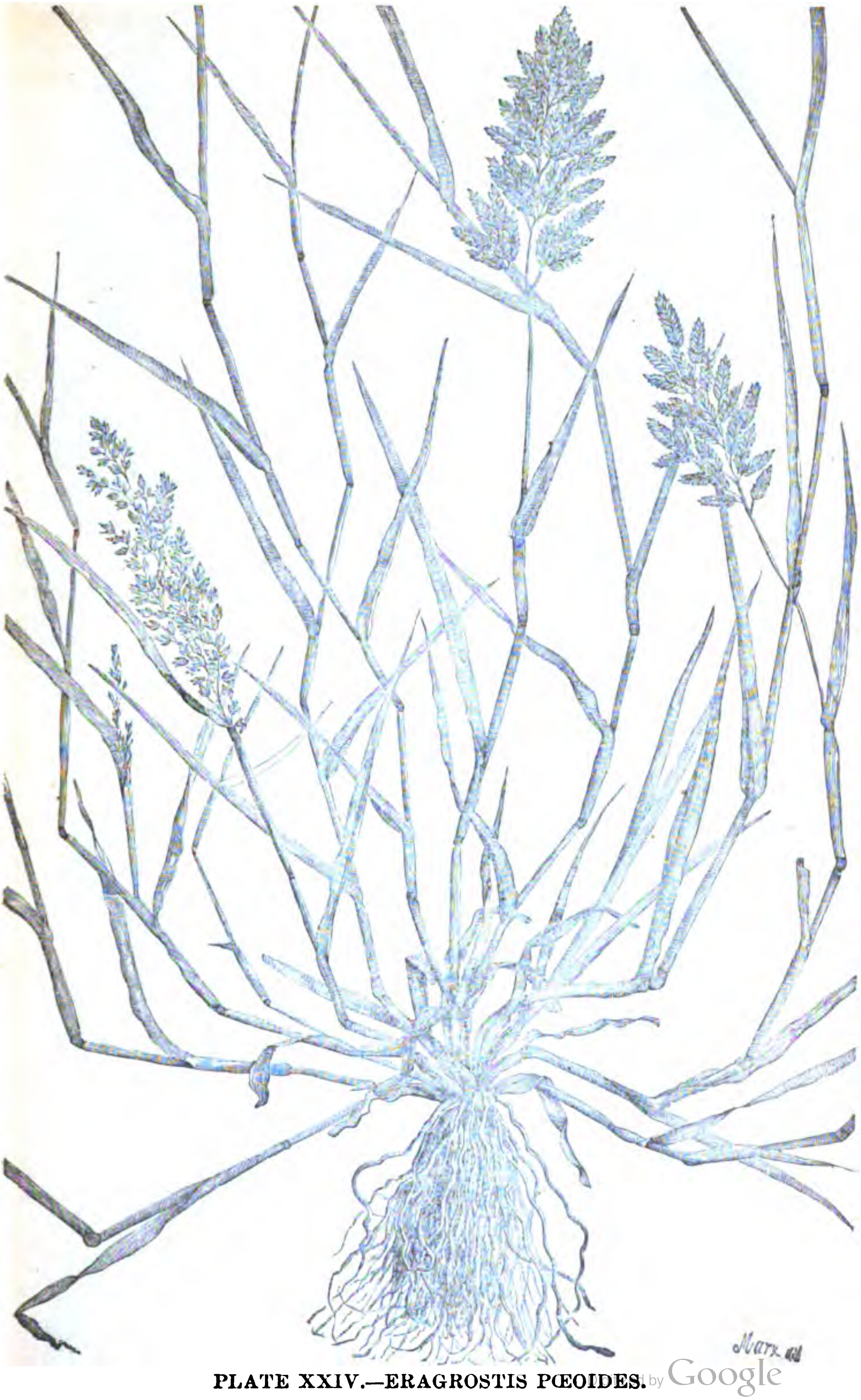

PLATE XXIV.—ERAGROSTIS PŒOIDES.

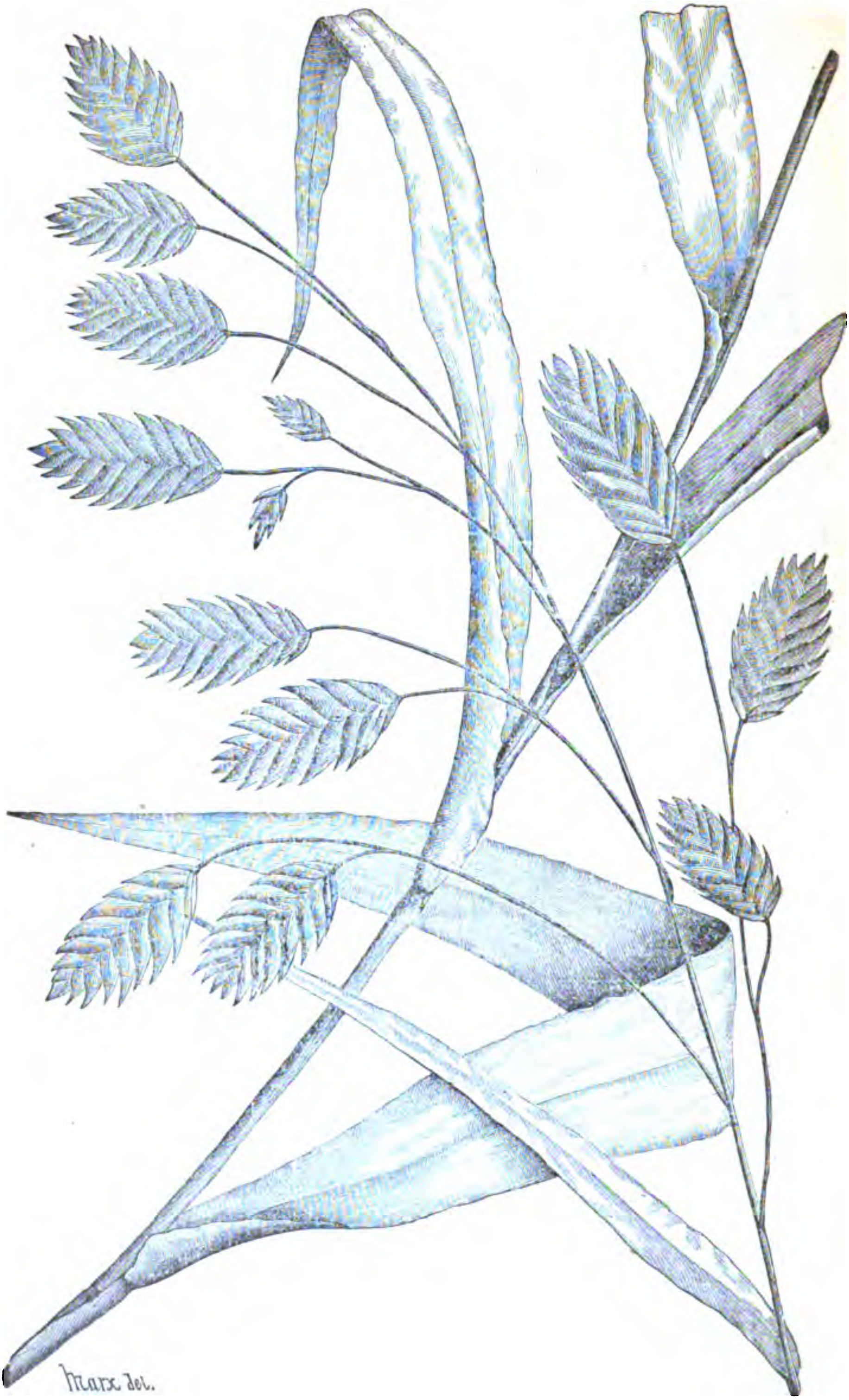

PLATE XXV.—UNIOLA LATIFOLIA.

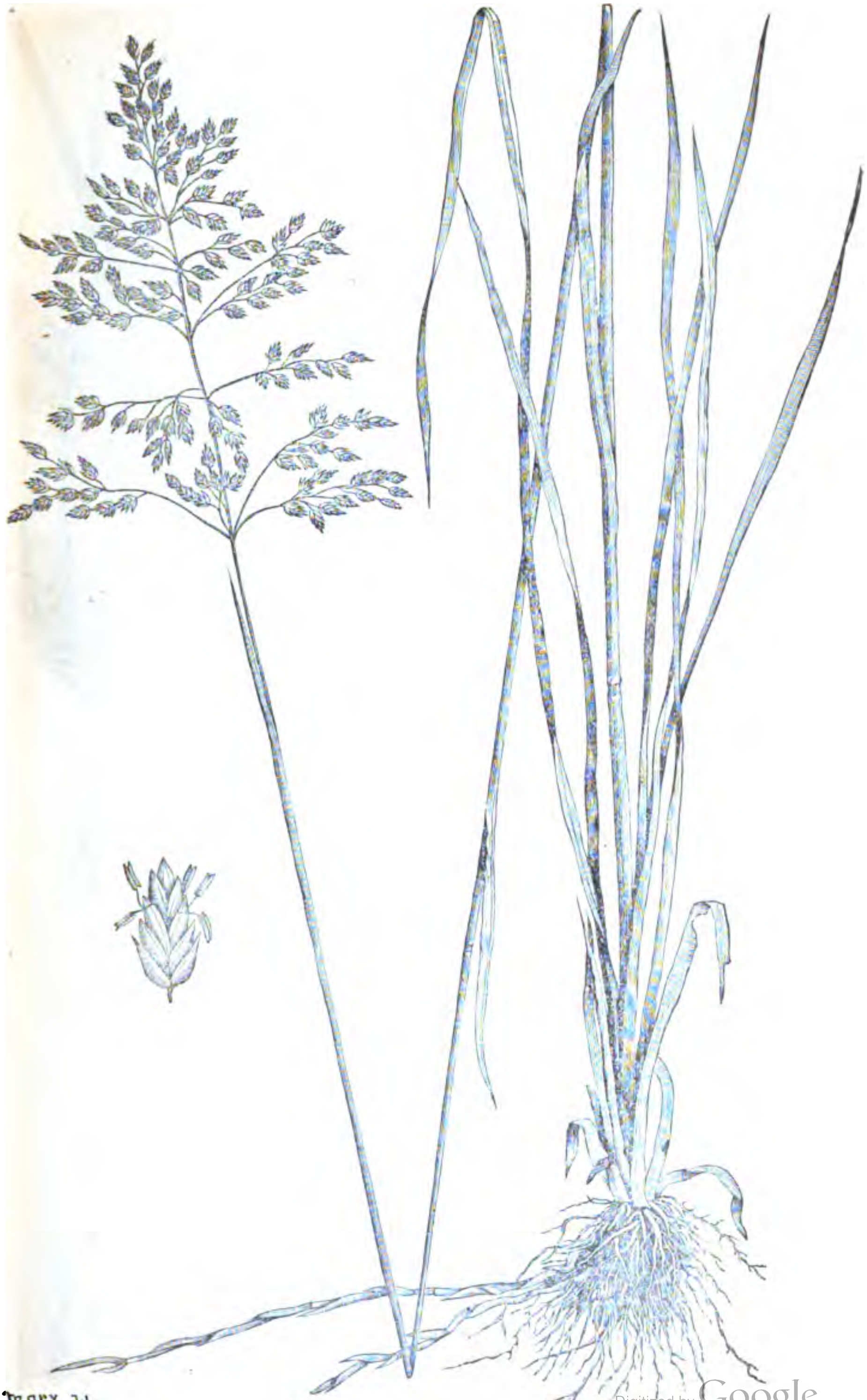

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PLATE XXVI.—POA PRATENSIS.

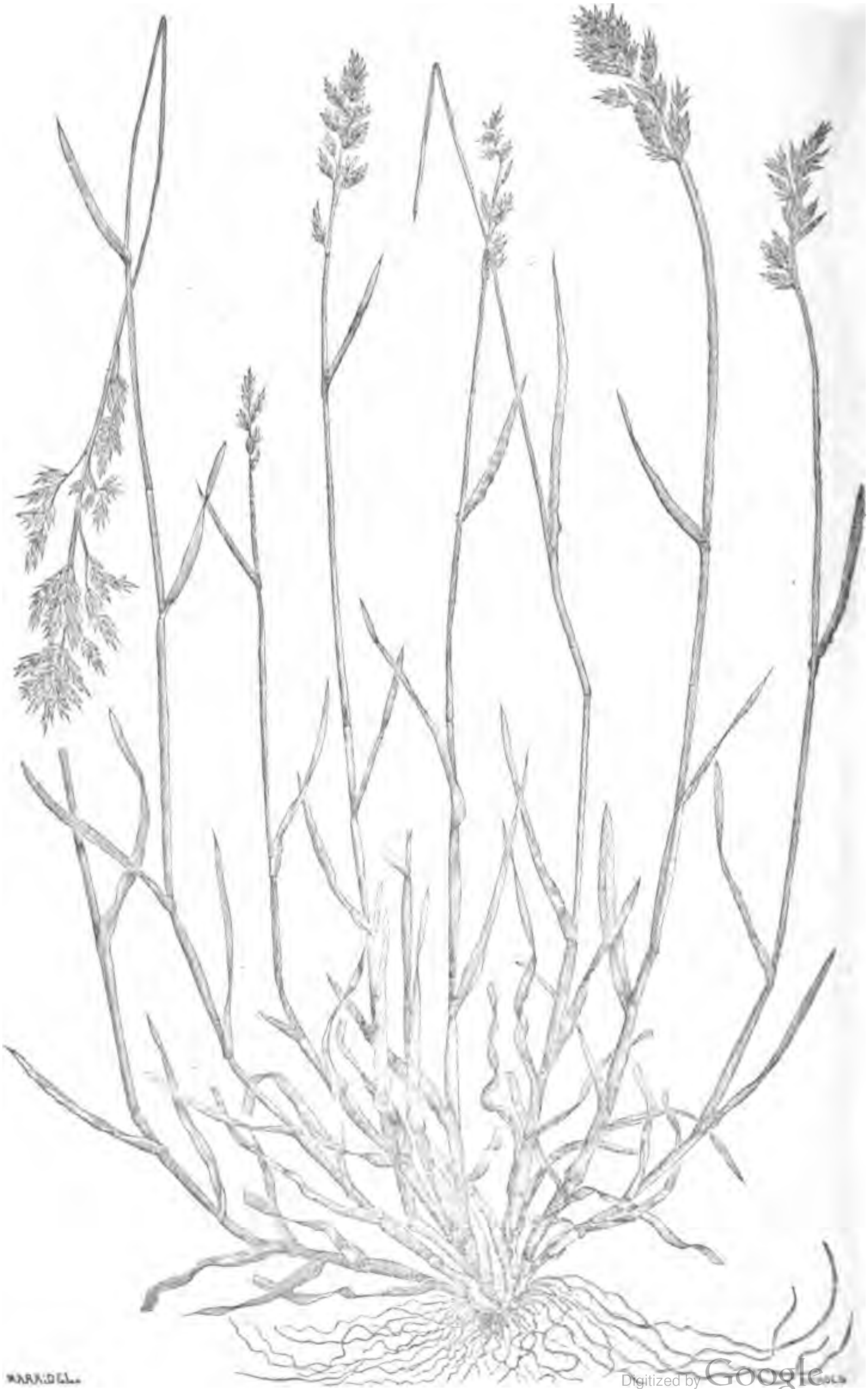

PLATE XXVII.—POA COMPRESSA.

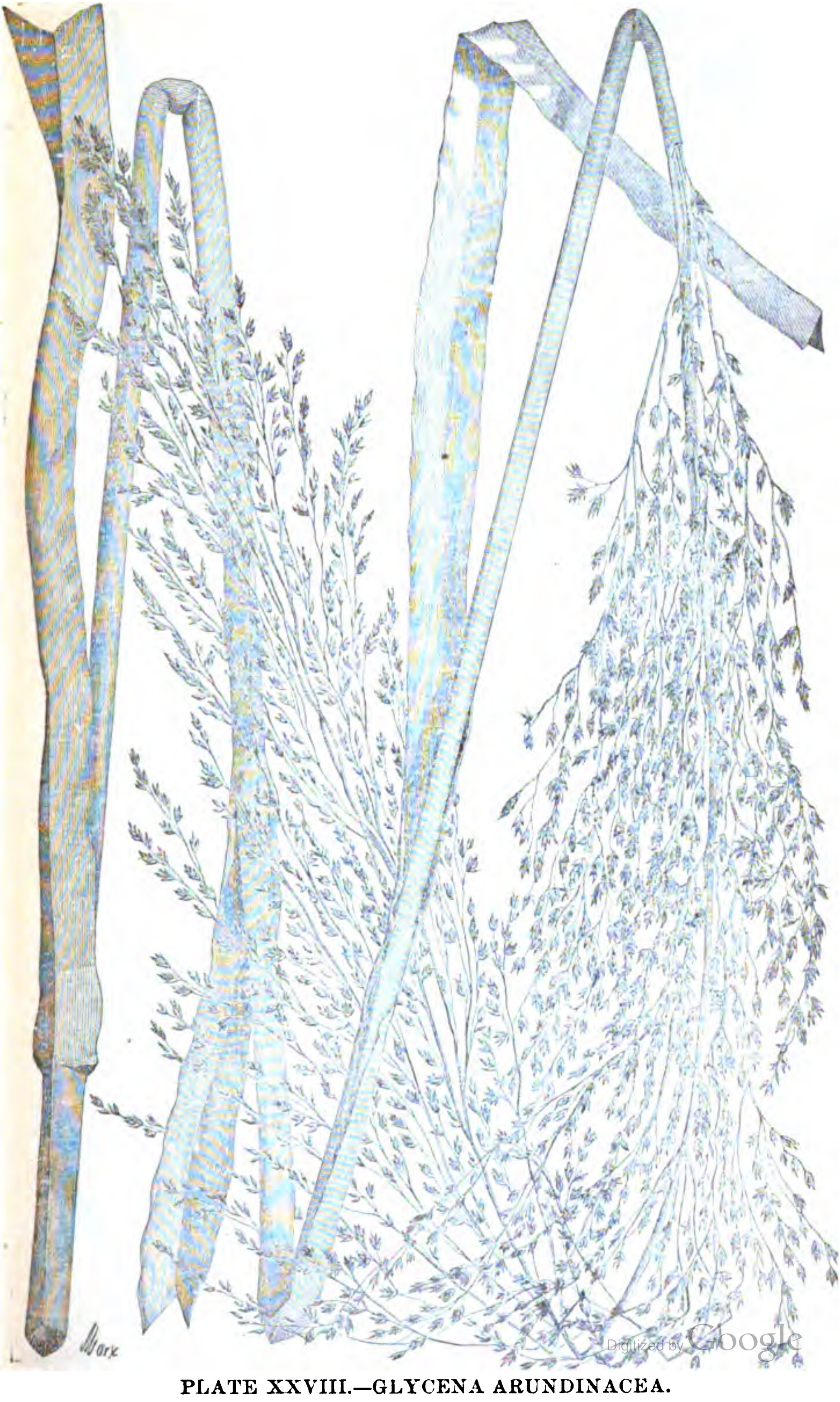

PLATE XXVIII.—GLYCENA ARUNDINACEA.

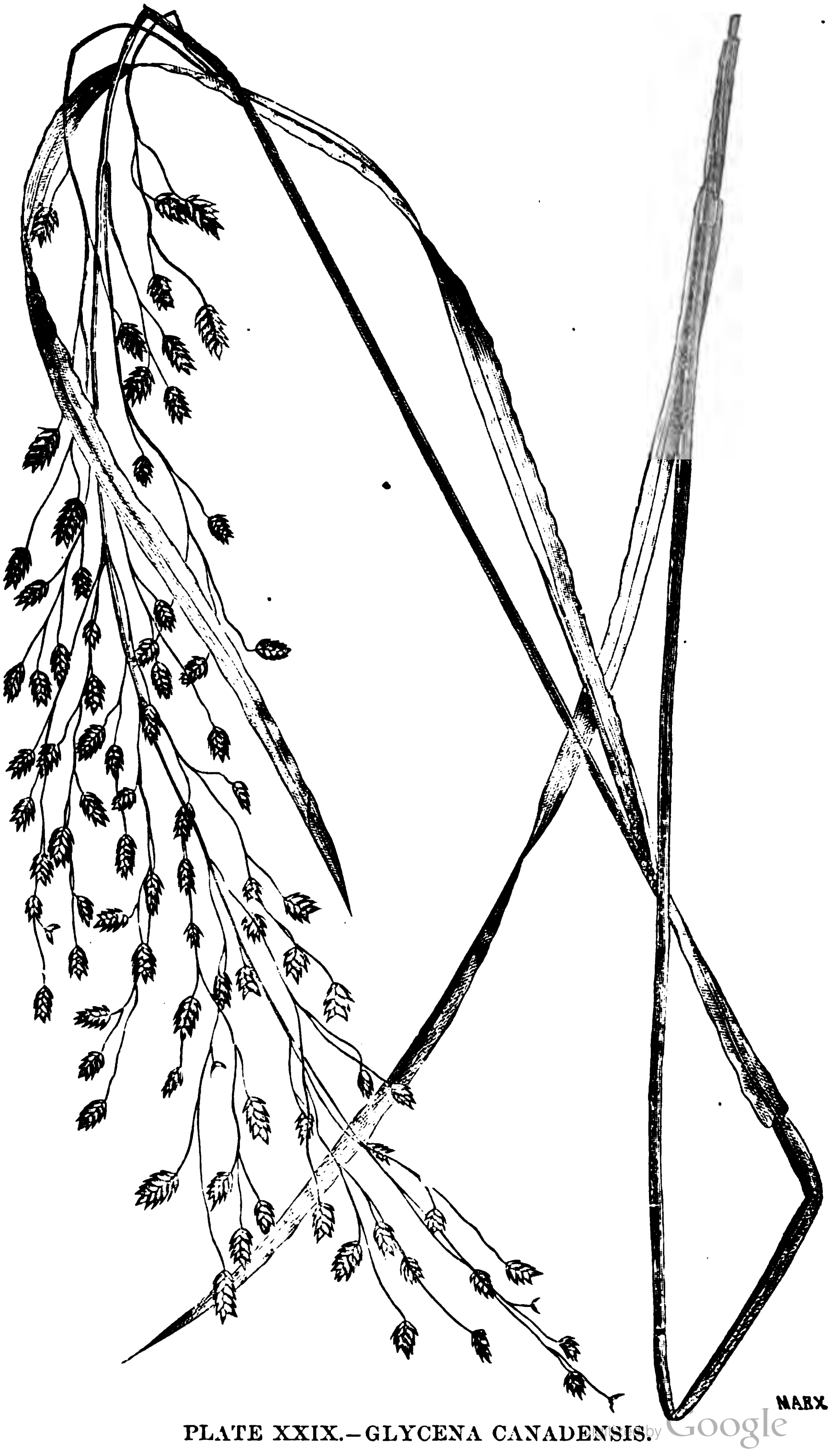

PLATE XXIX.—GLYCENA CANADENSIS.

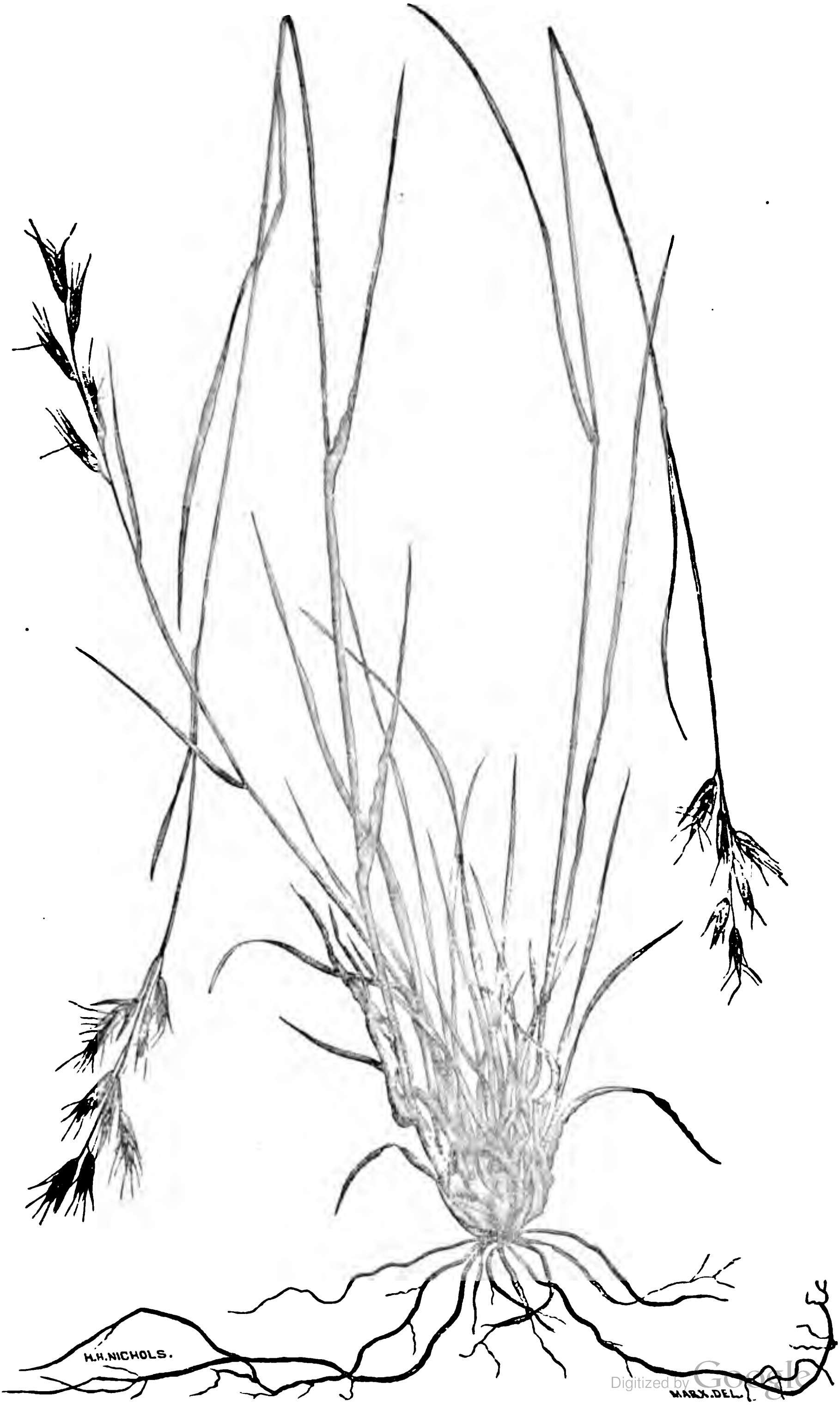
H.H.NICHOLS.
MARX.DEL.

PLATE XXX.—FESTUCA OVINA.

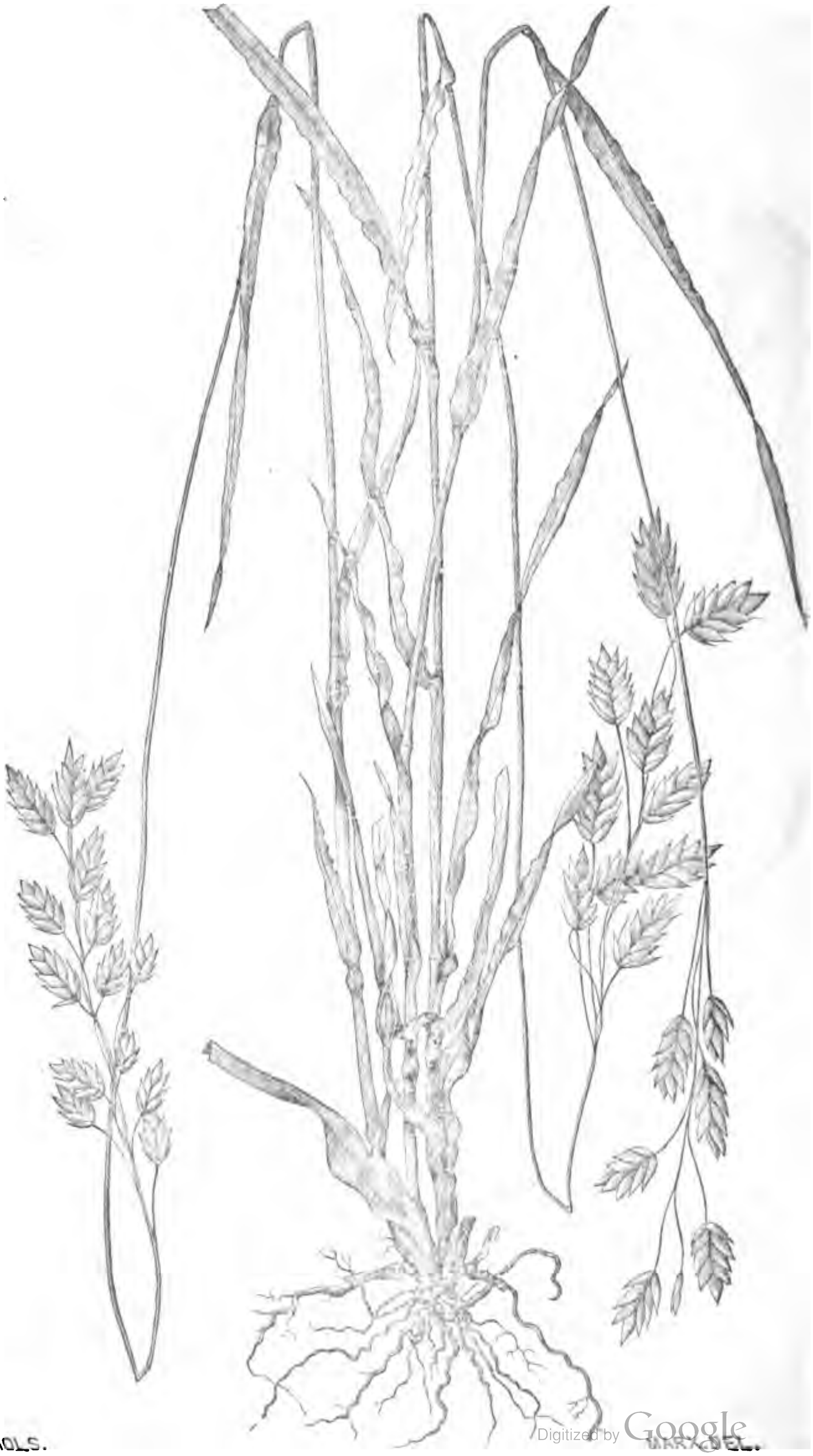

PLATE XXXI.—BROMUS SECALINUS.

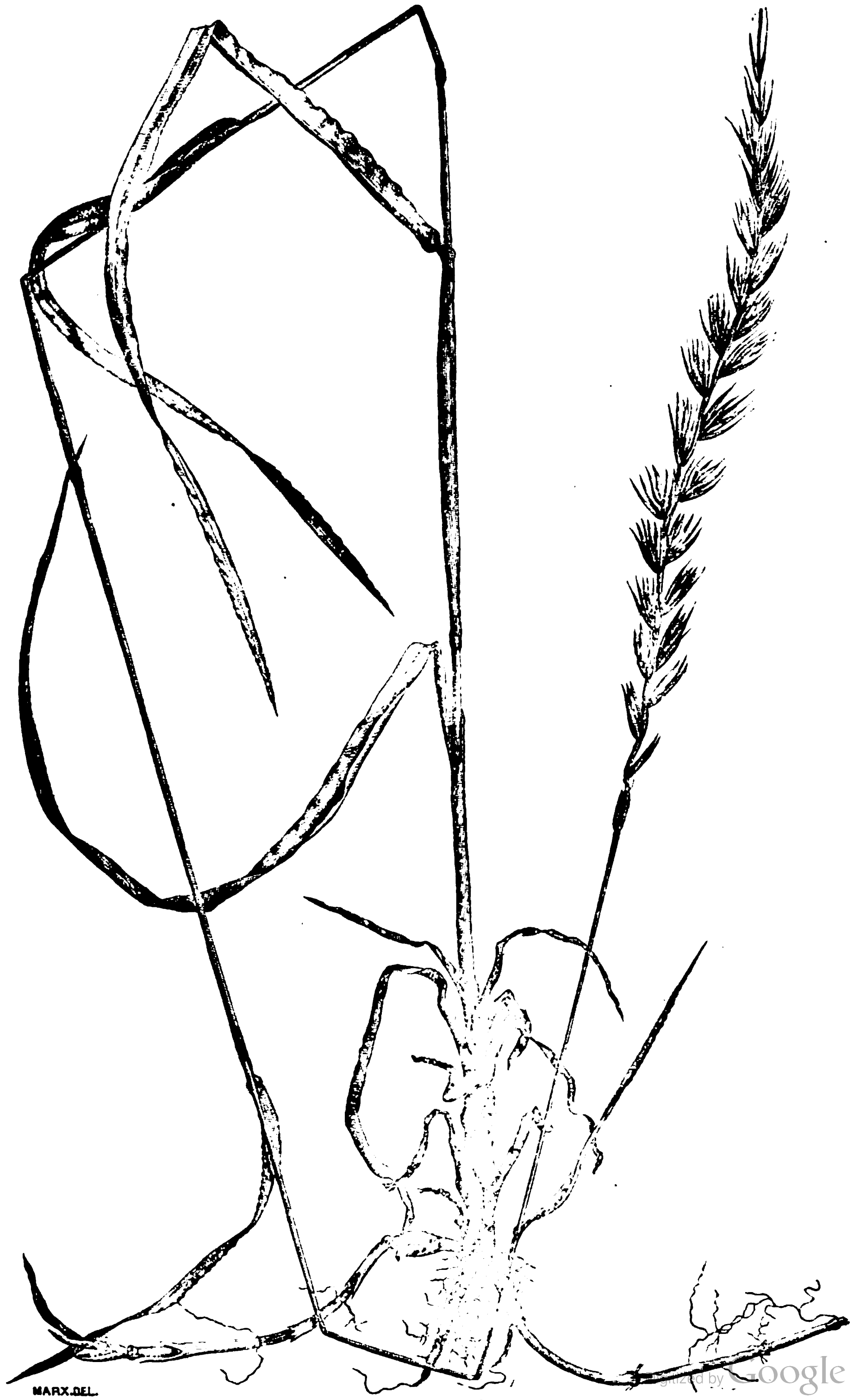

PLATE XXXII.—AGROPYRUM REPENS.

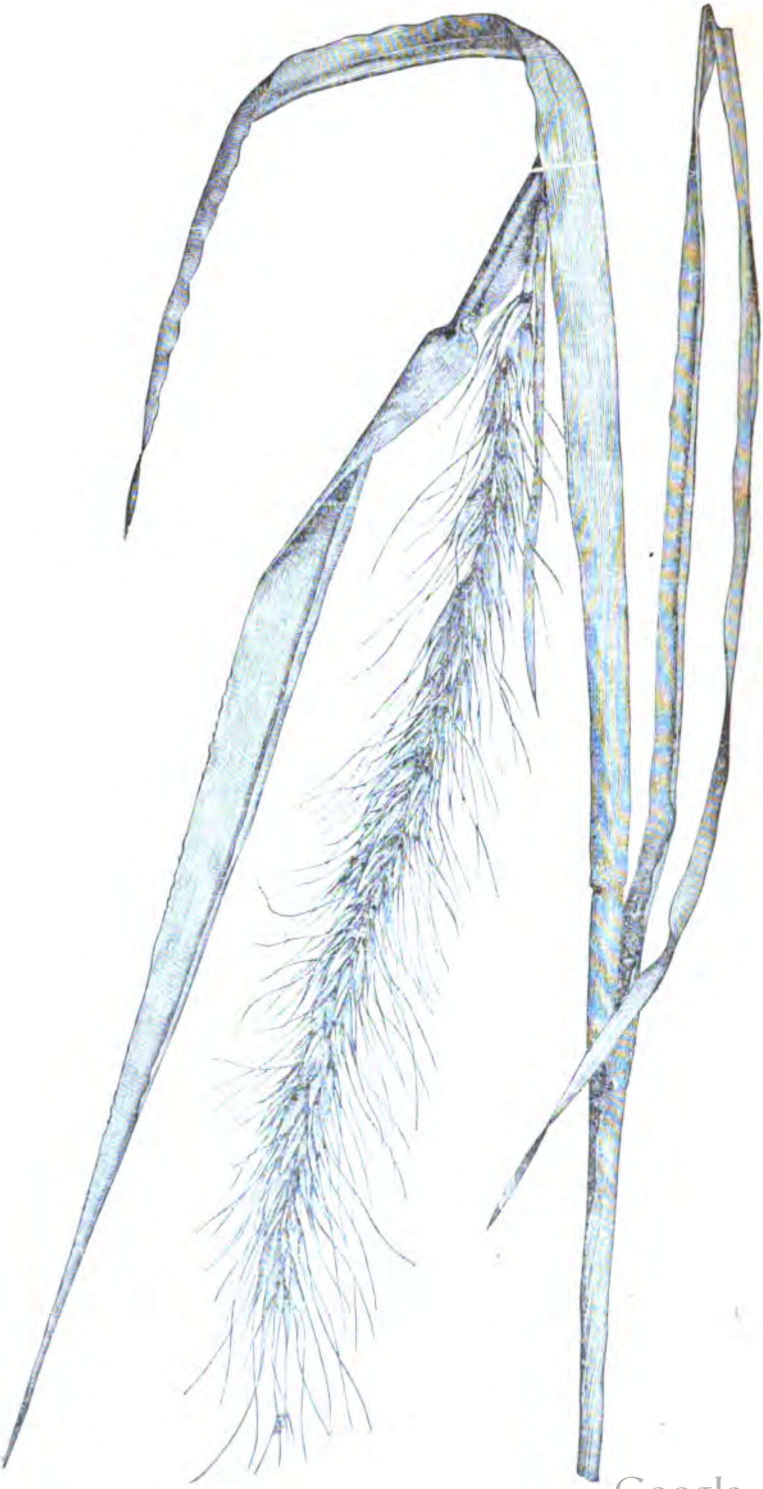

PLATE XXXIII.—ELYMUS CANADENSIS.

CIRCULAR TO COUNTY CLERKS.

The facts comprehend in the following table were furnished by the county clerks in response to a circular,—addressed one to the clerk of each county,—asking for information on seventeen enumerated particulars. The remarks appended to the table are in response to a request, in the foregoing circular, for information concerning the available water power, unsettled lands, and industrial progress of each county, and such other information as might be of interest to the citizens of this State and to those of other States who might desire to find homes in Missouri.

The general design of the foregoing circular was to obtain material for a statement, as full as possible, regarding the development of the agriculture of Missouri, the increase of her population, her growth in manufactures, and the extension of her railroads.

While regretting that the circular was not more generally answered, the Board desires to thank those public spirited officials who have voluntarily furnished information, which in the absence of laws for the collection of statistics could not otherwise be obtained.

COUNTIES.	Number of Manufacturing Establishments in County.	Amount of Capital invested in above Establishments.	Number of Persons employed in above Establishments.	Value of Productions of manufactures.	Number of miles of Railway in County	Number of votes enrolled in 1880....	Number of votes enrolled in 1884....	Total area of County in acres..........	Number of Banks in County..........
Atchison		$		$	60.0	2,981	3,268	325,778	7
Audrain	8	50,000	45	500,000	76.5	3,935	4,586	433,100	5
Barry	2	12,000	15		46.5	2,875	3,356	528,000	
Barton	5	40,000	60		56.0	2,173	3,620	368.522	4
Bollinger	3	20,000	50		24.6		2,139	362,240	
Boone,	9	54,000	50		40.0	4,871	4,954	422,226	7
Caldwell	8	86,500	25	22,000	26.0	2,656	3,198	276,480	5
Cape Girardeau					52.8	3,511	4,164	381,440	1
Carter						4,000	4,500	320,000	
Cass	9	136,000	100	750,000	15.5	4,696	5,336	441,644	8
Cedar						2,084	3.021	368,640	4
Christian	1	5,000	10	10,000	30.0	1,870	2,200	359,040	
Clinton					90.0	3,489	3,879	268,800	6
Harrison	2	12,000	10	30,000	35.0	3,922	4,125	460,800	5
Howell	14	245,000	300	260,000	40.2	1,352	2,483	584,960	1
Jefferson	1	1,000,000	1,500		30.9	3,574	4,176	403,612	2
Laclede	6	45,000	80	125,000	36.0	2,102	2,462	475,000	1
Lewis	13	110,000	250	335,000	44 9	3,081	3,497	303,414	5
Lincoln					53.9	3,463	3,572	390,813	1
Livingston	31	126,500	192	427,896	48.0	4,292	4,290	345,000	2
Macon	8	50,000	45	250,000	63.0	5,450	5,732	531,200	3
Mercer	11	33,000	70		40.0	2,750	2,793	339,200	1
Mississippi					62.0	1,661	1,944	247,761	
Morgan	1	10,000	12	17,500	20.0	1,805	2,157	385,919	1
Oregon					14.2	1,100	1.500	515,840	
Randolph	7	185,000	100	250,000	80.9		5,050	310,000	4
Ripley					15.9	945	1,214	418,080	
St. Clair	1	900			51.0	2,695	3,343	446,170	3
Scotland	10	40,000	40	120,000	22.5	2,573	2,632	288,000	2
Stoddard	20	100,000	500	200,000	45.3	2,225	2,474	480,000	
Stone								326,400	
Warren	2	30,000	40		18.0	2,225	1,991	250,010	1
Webster					48.9	2,019	2,545		1

Aggregate Capital of Banks.........	Estimated Forest area of County in acres.........	State aid to Schools in County in 1885.	County aid to schools in County in 1885.	Tw'p aid to Schools in County in 1885.	Number of miles of Graveled Road in County.........	Cost of Gravel Road per mile.........	Name and address of Secretary of County Fair Association.
$146,000	30,000	$4,178	$ 12,896	$ 3,482	......	......	C. F. Harwood, Tarkio.
315,000	43,000	5,248	1,357	3,224	......	......	J. J. Steele, Mexico.
....	256,000	4,974	2,356	2,896	......	......	....
100,000	3,685	5,060	6,000	3,000	4	$2,000	W. J. Miller, Lamar.
....	241,472	3,625	3,043	866	......	......	....
250,000	125,000	6,500	20,014	40,007	54	3,500	J. W. Lawson, Columbia.
135,000	....	3,539	3,862	1,673	......	......	A. C. Menefee, Hamilton.
30,000	127,147	6,295	2,814	1,362	35	......	H. A. Asthole, Cape Girardeau.
....	224,000	750	92	1,151	......	......	....
150,000	70,000	6,768	8,838	4,370	......	......	....
57,000	184,320	4,614	4,011	....	......	......	Wm. Huestone.
....	233,376	3,100	500	1,000	......	......	....
75,000	22,400	4,363	802	1,396	......	......	....
70,000	115,200	6,176	5,821	3,034	......	......	J. E. Wilson, Bethany.
15,000	292,480	3,741	....	437	......	.....	H. Green, West Plains.
20,000	....	5,278	1,003	3,428	55	5,000	J. Walker, Hillsborough.
25,000	....	3,712	1,338	1,267	......	......	C. M. Wilson, Lebanon.
80,000	75.853	4,484	1,802	1,301	......	......	Abner Bozarth, La Grange.
10,000	97,703	5,145	1,647	1,903	......	......	Wm. H. Wells, Troy.
78,000	115,000	6.105	11,939	2,212	......	.....	....
80,000	212,480	8,102	7,105	....	......	.....	Frank Baird, Macon City.
100.000	92,800	4,323	2,608	1,141	......	......	C. E. Spear, Princeton.
....	165,174	2,385	5,976	....	......	......	....
10.000	192,958	3,208	....	988	......	......	....
....	....	1,875	3,500	400	.. ..	......	R. F. Royle, Thomasville.
40,000	206,667	6,683	1,144	1,524	......	......	W. A. Wight, Moberly.
....	292,656	1,980	96	280	......	.....	....
150,000	334.626	4,402	2,714	1,330	......	......	Chas. W. Nesbit.
100,000	72,000	3,138	3,508	998	......	......	R. D. Cramer, Memphis.
....	320,000	4,030	850	1,024	......	......	....
....	261,120	1,602	161	311	......	......	....
10,000	125,0 5	2,645	9,505	813	1	......	....
10,000	376,960	4,592	2,706	507	......	......	....

REMARKS ON WATER POWER, ETC., ETC.

ATCHISON.

The water power of the county is good, there being numerous streams sufficiently large to run good mills. Nearly every section of land has good living water on it. Our lands are all entered, and in a high state of cultivation. Our citizens are all intelligent and law abiding. Our taxes are as low as those of any county in the State, and we extend a general invitation to all who seek homes in the West to come and see Atchison county.

D. A. McCOLL.

AUDRAIN.

There is no water power in this county, and but little land not in cultivation or pasture. The county is out of debt and has good graded roads with bridges, mostly combination and iron, over all streams and crossings. The lands have no superior for grass of any kind, and have increased in value at least fifty per cent. in the last six years. Our citizens are prosperous and have good churches and schools. We have a public school fund of more than $50,000; also an amply endowed female college. No county can offer superior advantages to the industrious and progessive citizen.

B. L. LOCKE.

BARRY.

We have fine water power. There are in our county four water, and eight steam flouring mills; also four steam saw mills. Our lands are excellent, both for farming and grazing, being adapted to clover and tame grasses. The crops raised are: wheat, corn, oats, tobacco, grasses and fruit. There are five large fruit evaporating establisnments in the county.

M. L. ABERNATHY.

BARTON.

No county indebtedness. All in a flourishing condition and every one happy. A splendid county for all kinds of tame grasses. Also good for corn, oats and wheat. The best stock country in Southwest Missouri. We have a permanent school fund of 70,000, and a township school fund of $30,000.

O. O. DAUBIN.

BOLLINGER.

Water power is excellent; many running streams. A vast amount of good land for sale at from $2 to $5 per acre, heavily timbered.

J. M. SNIDER.

CAPE GIRARDEAU.

Apple creek, on the north, and White Water river, in the western part of the county, and numerous smaller streams afford excellent water power. Our county is improving slowly but steadily. We have a large German population, and the best lands in the county have fallen into their hands.

G. O. PEPPER.

CARTER.

We have some good water power in this county. Quite a lot of unimproved lands susceptible of cultivation. We need a railroad, and have a fair prospect of one in the near future.

J. M. McGHEE.

CEDAR.

We have in this county one stream—Sac river—affording the best water power in Missouri, and other small streams with very good water power. A great abundance of fine timber, a very rich soil, and, in the eastern portion of the county and along Sac river, fine prospects for lead and other minerals. Abundance of coal in western portion of the county. We are fifteen miles from a railroad, and no doubt a railroad either east and west or north and south, would pay as well as one through any county in Missouri.

G. L. WALKER.

CHRISTIAN.

Any amount of fine water power from numerous streams. A large body of unsettled land. 40,000 acres government lands in Christian county on the market. Immigration is pouring in and the prospects of the county are first-class. Any amount of fine agricultural lands for sale cheap by non-residents.

JNO. C. ROGERS.

CLINTON.

Very little unsettled land in this county. A great many shorthorn cattle are raised and shipped to various parts ot the country from this county.

GEO. R. RILEY.

HARRISON.

Grand river runs through the eastern part of the county from north to south, and furnishes water power at least equal to a forty horsepower engine. This is the only stream in the county furnishing water power sufficient for milling purposes. About one fourth of the land is yet unsettled, being principally in the hands of speculators. Raw land is worth from $1.25 to $15.90 per acre. Improved land is worth from $15 to $40 per acre.

W. P. ROBINSoN.

LACLEDE.

There is some unsettled land in this county; it is best adapted to grass. This is a fine stock country; good water and wild pasture. The Niangue river furnishes splendid water power on the west and north, while the Gasconade and Osage rivers afford most excellent power on the south and east. Lebanon is a city of 2,500 inhabitants with good churches and schools.

W. A. JOHNSON.

LINCOLN.

Cuivre river passes through the center of this county, affording ample water-power for the very best flouring mills. We have a saw and grist mill at Moscow run by water-power, which is one of the best mills in the State. Timber supply is inexhaustable. Large quantities of walnut, oak and sycamore are rafted annually. Ash, hickory and sugar trees are here in abundance.

W. A. WOODSON.

LIVINGSTON.

Livingston county lies in North Central Missouri in the heart of the famous Grand river valley, and was organized in 1837. Below is presented statistical data obtained from official sources, which will give the reader an insight into the state of affairs existing.

WEALTH, LIABILITIES, ETC.

Total assessed valuation	$4.932,417 54
Assessed value of real estate	2,217,808 00
Assessed value of town lots	605,450 00
Assessed value of personal property	1,605,088 00
Assessed value of railway and telegraph lines	504,071 54
Rate of taxation (except school tax) per 100	1 00
Floating debt	16,000 05
Average assessment of land per acre	6 25
Permanent school fund	124,772 35
Expended annually for educational purposes	46,020 74
Population in county	18,000
Number of school-houses	105
Scholastic population	7,217
Scholastic term	4 to 9 months.

LIVE STOCK.

Kind.	Number.	Assessed value.
Cattle	25,307	$364,009 00
Swine	32,495	71,170 00
Sheep	19,416	20,000 90
Horses	8,594	316,430 00
Mules	1,136	53,185 00
Asses (not all counted)	29	1,702 00

SELLING VALUE OF LANDS.

Improved farms, per acre	$20 to $40
Unimproved and bottom lands	3 to 8

PRODUCTS AND YIELDS.

Kind.	Yield per Acre.
Corn	45 to 85 bushels.
Wheat	15 to 25 "
Oats	25 to 55 "
Flax-seed	12 to 15 "

Churches are found in every neighborhood.

Rye, buckwheat, barley, millett, tobacco, sorghum and all the domestic grasses, as well as fruits, do well, and form important features in the pursuits of the farming classes. This is also a fine grazing county and considerable attention is being paid to the breeding of fine stock, and many fine stock farms are found. The climate is all that can reasonably be desired, and the country is as healthy as any locality in the United States in the same latitude. Water is abundant and timber of many and valuable varieties is found along the streams. It will be observed that lands here are very reasonable in price and that the rate of assessment is low. Being excellent for grazing, as well as agricultural purposes, they offer splendid inducements at this time to men who desire to come here for the purpose of building up new homes. An excellent class of people are found, who believe in progress and civilization, and are anxious to see the county settled by a new element, and will make the new-comer feel at home among them, no matter what his political faith may be.

Chillicothe, the county-seat of Livingston county, contains a population exceeding 6,000, lies in the geographical centre of the county, and has two railways, the H. & St. J. and W., St. L. & P. R. R. It has two fine public schools, two Catholic schools, five churches, an opera-house, city hall, two mills, two elevators, two banks, a file factory, a tobacco factory, three newspapers, six hotels, and a full completement of stores of every description. The business houses are built around a square, upon which is a beautiful park, while the business houses, as well as the residences, denotes solidity and wealth. A creamery is among its wants, while factories of almost any description would do well there.

Water power:—There are four good mill streams in the county, Shoal creek, Medicine creek, and East and West Grand river. Three water-mills are now in operation, and there are numerous choice mill-sites.

Unsettled lands.:—The lands are all entered and practically all settled, but many unimproved. No government lands. The H. & St. Joe R. R. owns 5,000 acres in this county. Prices of all lands are below their real value.

Industrial progress, etc.:—The progress, present condition and future prospects of the county are satisfactory to comtemplate. Two important railroads traverse the county; the H. & St. Joe, east and west; and the Wabash, north and south. The Milwaukee & St. Paul has been surveyed through and is certain to be built within two years. The county is out of debt and taxes are low. Plenty of excellent schools and churches. All three political parties are represented in the county offices. The soil is all productive, and in variety of products will compare favorably with that of any other in the State. The low lands are excellent for grass. Even in the lowest bottoms blue grass grows luxurantly where the land is drained. The old timber lands are best for wheat and fruit products. The white oak lands are especially valuable for apple orchards. Plenty of good building sandstone and limestone; gravel pits are worked; an excellent quality of coal is found at moderate depths, and is mined to some extent; abundance of most excellent timber. We have room for more immigrants and will gladly welcome them.

T. B. BROOKSHIER.

MACON.

The soil of Macon county is naturally divided into three classes: The first, equal to any in the State, is composed of the valley-lands; the second, of the prairie table-lands, and the third of the breaks in the table-lands where they make down to the valleys. The table-land soil is underlaid with a rich marl-bed, near at hand, making the richest pasture lands to be found in any country. The county is well watered by numerous streams coursing through it; the most notable of which is the Grand Chariton river, running through the county from north to south.

JAS. G. HOWE.

MERCER.

Land lower here, I think, considering improvements, quality of land and accessibility to market, than anywhere else on the earth; selling from $7 to $15 per acre. Princeton, the county seat, is 396 miles, by the Chicago, Rock Island & Pacific railroad, from Chicago; 130 miles from Kansas City, and about the same distance from St. Joseph, Mo. The C., R. I. & P. railroad crosses our county from north to south through the center. The Des Moines, Osceola and Southern railroad crosses from the north at at a point one and one-half mile east of the northwest corner of the county, and runs ten and one-half miles in a southwesterly direction to Camsville, Harrison county, where it passes out of our county. A party of railroad engineers are surveying from east to west through the county, near a line that has been run three times before in the last ten years.

J. M. ALLEY.

MISSISSIPPI.

We have no water power in our county; but plenty of unsettled, tillable lands, as good as can be found in the State. Our lands are constantly being settled up, and the rate of opening up new land within the past five years has been wonderful.

W. A. BUSH.

MORGAN.

The mill property in county is worth about $20,000. There is as good water-power in the southern part of this county as can be found in the State; the streams being fed by never-failing springs, and having plenty of fall. We have a very thrifty people; our county is comparatively new; and lands are cheap. We have good schools and churches and fewer criminals than almost any other county in the State. Our laws are well executed. Our county has a bright prospect in the way of railroad facilities, with one railroad running to the county seat and a prospect for another soon—the Emporia & St. Louis.

CALEB GUMM.

OREGON.

We have some of the finest water-power in the State, furnished by springs, that are large enough to run all the machinery that can be put on them. Eleven Point river enters the county at the northeast corner and leaves it at the southwest corner. This river is large enough to drive saw logs and raft lumber, and runs through the finest pine forest in the State. This pinery is in the north and northeast part of the county, where fine grazing land is also found. The remaining lands of the county are adapted to grazing and cultivation. We have a healthy climate, a fertile soil, and plenty of spring water. Land seekers would do well to give this county a look, as land is cheap. The K. C., Ft. S. & G. railroad entered this county about three years ago, and is bringing numerous immigrants.

M. G. NORMAN.

RANDOLPH.

The county is well watered by running streams, but no falls sufficient to run machinery, except by making dams. There is a very small area of unsettled lands in the county. The industrial progress of the county is gratifying, and the labor of farming is being lightened by the use of machinery. Rotation of crops and other means are being used to fertilize the soil, and the best methods of farming, formerly practiced by the most observing and energetic, are now followed by the great majority. Randolph county is considered one of the best blue grass counties of the State, and consequently stock-raising is becoming the leading industry, and the most prosperous farmers are in that line. Nearly the whole county is underlaid with coal, from two to four feet thick, which is being mined quite extensively.

J. W. WIGHT.

RAY.

Ray county is well watered, especially near the county seat (Richmond), where are found some of the finest springs in Northwest Missouri. Most of the prairie land is in cultivation or under fence, and the timbered land is being cleared up rapidly, especially in the valleys and bottoms, which are very fertile, producing corn, sweet potatoes and irish potatoes in great abundance. The uplands are, principally, being turned into pastures, producing the finest of blue-grass. The northern and northwestern portions of the county are rather rough and broken in places, but are well adapted to sheep-raising. For an area of about fifteen miles around Richmond, we have the finest of coal fields—in fact the whole county is underlaid with coal, which is now being taken out in great abundance. At Richmond we have seven coal mines open and running, convenient to railroad; also five or six within a short distance of railroad and town. For good farmers and stock-raisers I think there could be no better place than this county. What we need is more thrifty and energetic men. The county now has a population of about 25,000; and Richmond (the county seat) about 2,000, and improving greatly in number and quality of buildings.

GEO. W. TRIGG.

RIPLEY.

Water power is unexcelled in the State. A great deal of land is held by speculators. The industrial progress of the county has been very marked since the construction of our railroad, in March, 1882.

J. K. LANGFORD.

ST. CLAIR.

The water-power of this county is splendid, and we think equal to that of any county in the West. There is a large amount of unsettled land in the county, but it is not valuable, being rough and broken. The prospects of the county are better than ever before. And with the present prospect of greatly increased railroad facilities, we shall, ere many years, have a good county. We have inexhaustible hills of the finest coal, easily mined; all kinds of ore, except gold; the finest of hard timber and building stone in every portion of the county. We have also a great deal of clouded sand stone, and lime stone that makes splendid lime. Land is strictly on the increase, and is being rapidly enhanced in value by improvements. Splendid quarries of blue and clouded marble or granite being operated in this city.

THOS. D. HICKS.

SCOTLAND.

The land is splendid farming and grass land. The surface is diversified with rolling prairie, table and bottom lands; selling at from $5.00 to $50.00 per acre, according to location. Timber sufficient for fencing, building and fuel; plenty of good water; fruit raising is a success, principally of the smaller fruits, which yield largely. The cultivation of tobacco, which is assuming large proportions, has proven profitable. Corn and oat crops good; hay crops generally good. Have a cheese factory and creamery in Memphis, the county seat, doing a good business. This county is situated in the northern tier of counties of the State, forty miles from the Mississippi river, and is well supplied with transportation to the markets of the county. Considerable immigration is being had yearly.

J. G. BEST.

STODDARD.

Our manufacturing establishments are saw mills, flouring mills potteries, stove factories, etc. The water power of the county is not extensive; but the Castor river, flowing through the county, furnishes some excellent mill-sites. The unsettled lands of the county are mostly bottom lands; are generally well timbered; and are adapted to grain, grasses and cotton. The industrial progress of the county is fair, with the prospect of better railway facilities in the near future.

STEPHEN CHAPMAN.

WARREN.

Warren county, Mo., is located in the eastern part of the State, having the Missouri river for its southern boundary, which, with the many streams in the southern part of the county leading into it, and those of the northern portion of the county which lead into the Mississippi river, furnish a large area of very fertile land. The Wabash, St. Louis & Pacific Railroad, running almost through the center of the county from east to west, affords many advantages and inducements. The soil is fertile and productive, well adapted to farming and stock raising, being well supplied with springs and water-courses. As to health, the locality can not be surpassed; vegetation is luxuriant; and we possess almost every other advantage necessary to promote the general welfare and progress of this portion of the State.

J. H. KOELLING.

WEBSTER.

The water facilities of Webster county are good, there being some six water-courses that head in and run through the county, and no end of fine, cold springs. We have a large amount of unimproved lands, which could be made valuable for farming and stock raising. The county is improving and settling up very rapidly.

G. A. TURNER.

CHEAP LANDS IN MISSOURI.

U. S. GOVERNMENT LANDS.

These lands are located in three districts, as follows:
Boonville district;
Ironton district;
Springfield district;
The offices of the registers of lands for these districts are located at Boonville, Ironton and Springfield, respectively.

BOONVILLE DISTRICT.

The location and amount of the lands in this district are exhibited in the following table:

Benton county	40,000
Cedar "	1,000
Crawford "	12,000
Camden "	150,000
Dallas "	20,000
Hickory "	20,000
Laclede "	20,000
Maries "	2,000
Miller "	10,000
Phelps "	10,000
Polk "	3,000
Pulaski "	50,000
St. Clair "	10,000

IRONTON DISTRICT.

The location and amount of the government lands in this district are as follows:

Butler county	12,000
Bollinger "	15,000
Carter "	2,000
Crawford "	3,000
Cape Girardeau "	very little.
Dent "	8,000
Dunklin "	6,000
Howell "	200,000
Iron "	6,000
Madison "	18,000
Mississipi "	very little.
New Madrid "	3,000
Oregon "	60,000
Pemiscot "	5,000
Perry "	very little.
Pulaski "	" "
Phelps "	25,000
Reynolds "	5,000
Ripley "	22,000
Scott "	very little.
Shannon "	50,000
Stoddard "	10,000
St. Francois "	5,000
Ste. Genevieve "	5,000
Texas "	250,000
Washington "	3,000
Wayne "	18,000

Most of this land is in scattering and isolated tracts, and (outside of railroad limits) is for sale in any quantity at $1.25 per acre.

SPRINGFIELD DISTRICT.

This land district comprises some twenty counties and parts of counties in the southwest corner of the State. In most of these counties the government land is all taken up. Large bodies may still be found, however, south and east of Springfield, to wit:

In Douglas County	75,000 acres.
In Wright "	25,000 "
In Webster "	10,000 "
In Texas "	75,000 "
In Ozark "	125,000 "

(On the line of the Ft. Scott & Gulf R. R.)

Also in the counties of Stone, Christian and Taney. "The lands still remaining are all timbered—no prairie left. They are rolling, and in places rough, but are generally well watered and fertile. While portions are unsuited for cultivation, all are readily convertible into stock farms or ranches, for the raising of cattle, sheep, hogs, etc.

Corn, wheat, oats, rye, tobacco and fruit of all kinds are easily grown and yield well.

The timber comprises numerous varieties of oak; also walnut, hickory, elm, wild cherry, linn, maple ash, cedar, yellow pine, etc.

The tame grasses all thrive. Timothy and blue-grass, however, take the lead. Red clover grows well wherever introduced.

The Kansas City, Springfield & Memphis railroad (now completed), and the White River Branch of the St. Louis & San Francisco railroad (now in course of construction), traverse several of the counties above mentioned, and give to the settler easy access to the best markets of the country, north and south, for his surplus productions.

The winters are usually short and mild, little feed being required to carry stock through. The climate is healthy and the people law-abiding and peaceful, with abundant provisions for public schools."

AGRICULTURAL COLLEGE LANDS.

By request, O. B. Rollins, Esq., furnishes this office with the following facts regarding these lands:

"Under an act of Congress of the United States, approved July 2d, 1862, entitled, 'An act donating public lands to the several States and territories, which may provide colleges for the benefit of agriculture and the mechanical arts,' therewas granted to the State of Missouri, and she was entitled to select within her own borders, 330,000 acres of the unappropriated government lands. This acreage was reduced, however, to about 280,000 acres, owing to a provision of said act, 'that where lands were selected within the railroad belt, one acre should count for two.' By subsequent act of the General Assembly of the State of Missouri, this grant was accepted, and the lands thus acquired were placed under the control and government of the Board of Curators of the University of the State.

"These lands were carefully selected, principally in 1866, when there were millions of acres of land to select from, and were located in a region unsurpassed for healthfulness; where the scenery is equal to any in the State; the waters abundant and pure; the valleys and uplands rich and fertile, especially adapted to the growing of fruits, and at the same time yielding the cereals with as great certainty as our prairie lands, and in addition, covered with the most valuable timber, and filled with important minerals. These lands were located in the southern part of the State, and the original grant has been reduced by sale to about 75,000 acres, which are still on the market, and being sold every week, and located as follows:

COUNTIES.	Acres.
Crawford	2,000
Cedar	2,000
Pulaski	3,500
Laclede	7,000
Phelps	8,000
Dunklin and Pemiscot	1,000
Butler	13,000
Ripley	10,000
Benton	2,100
Wayne	12,000
Polk	2,000
Dallas	4,000
Webster	7,500

"In 1871–72, these and all the lands then owned bv the Agricultural College were carefully appraised by reliable agents appointed for that purpose, who visited each 160-acre tract and fixed a price upon it from actual survey. Although the value of lands in Missouri has doubled since that time, the prices of the College lands have not been changed. The title to these lands is absolutely perfect, in fact, the same as government title. They have never been subject to taxation, and a person is never annoyed by back taxes."

The prices of these lands vary from $1.50 to $3.00, per acre, and they are for sale by C. B. Rollins, Columbia, Mo., and Fisher & Co., No. 744 Chestnut street, St. Louis, Mo.

LANDS HELD BY RAILROADS.

The only railroads holding for sale any considerable tracts of land in Missouri, are the St. Louis & San Francisco and the St. Louis, Iron Mountain & Southern.

The St. Louis & San Francisco railroad holds the original grant of 1,665,195.66 acres granted by the U. S. government to the State of Missouri, and by it given to the company that should build a railroad southwesterly through that State to the west boundary thereof. These lands are located are as follows:

In Franklin County	6,000 acres.
In Crawford "	35,000 "
In Phelps "	46,000 "
In Maries "	3,000 "
In Pulaski "	6,900 "

These lands vary in price from one to seven dollars per acre, according to the quality of the land and its nearness to a depot.

When a sale is made on credit, seven years time will be given the purchaser, if desired. On sales of $200 and upwards, a payment of one-tenth cash will be required, and $20 on sales of less amount; deferred payments bear seven per cent. interest. Contracts, however, are made on shorter time if preferred, and the holder of a seven years contract may terminate the same at any time by paying the amount due, when the contract will be exchanged for a warranty deed.

The St. Louis, Iron Mountain & Southern R. R. offers for sale the following lands, viz.:

	Acres.
In Ripley county	11,647.97
In Butler county	17,745.84
In Scott county	8,116.62
In Stoddard county	11,961.62
In Mississippi county	6,606.46
In Dunklin county	5,983.07
In New Madrid county	5 906,29
Total	67,967.87

These lands range in price from $2.50 to $5.00 per acre.

LAND COMPANIES.

The South-Missouri Land Company,—office in Kansas City, Mo.,—offers for sale the following lands, viz.:

In Texas county	9,500 Acres.
In Shannon county	7,500 "
In Howell county	40,000 "
In Oregon county	8,000 "
In Ozark county	10,000 "
In Douglas county	15,000 "
Total	90,000 Acres.

These lands are for sale at an average price of $3.00 per acre. In addition to this, the same company holds 150,000 acres of pine lands not for sale at present.

The Ozark Plateau Land Company,—office at Lebanon, Mo.,—holds about 150,000 acres of farming and grazing lands, which it offers for sale at from $5.00 to $8.00 per acre. These lands are situated along the line of the St. Louis and San Francisco railway in the counties of Camden, Laclede, Dallas and Webster.

The Missouri Land and Live Stock Company,—office at Neosho, Mo.,—holds lands in Greene, Christian, Lawrence, Barry, Newton, Jasper and McDonald counties, which can be purchased at from $5.00 to $10.00 per acre on same terms as offered by the St. Louis and San Francisco railway.

"These lands are situated on either side of the above railroad, and comprise some of the best wheat and corn lands in the State."

Ozark Land Company,—office in St. Louis.

The officers of this company submit the following information relative to lands held by them:

"This company offers for sale 100,000 acres of land, located as follows:

In Reynolds county	50,000	Acres.
In Washington county	20,000	"
In Franklin county	14,000	"
In Dent county	4,000	"
In Phelps county	5,000	"
In Texas county	7,000	"
Total	100,000	Acres.

"These lands embrace many tracts well suited to cultivation, especially for wheat, tobacco, hay, small farming and all varieties of fruit; but most of them are better adapted to grazing purposes, nearly all of them now producing what is known as blue stem prairie grass, which, when closely pastured, is followed by a natural growth of the far famed blue grass. These lands are generally well watered, have a good growth of timber, embracing the several varieties of oak, hickory, ash, etc., and occasionally interspersed with fine groves of yellow pine. These lands range from fifty to one hundred and twenty miles in distance from St. Louis, and from one to twenty miles from railroads now in operation.

"They will all be sold at prices ranging from one to five dollars per acre in quantities to suit, embracing a great many small tracts and a few large bodies suitable for grazing purposes."

METHODS OF ACQUIRING TITLE TO PUBLIC LANDS.

The States and Territories containing government or public lands not yet disposed of, are divided into *land districts*, in each of which there is a land office established by law, with a register and a receiver in attendance for the sale or other disposal of the public lands in such district. Parties, so desiring, may obtain at these offices any proper information regarding vacant public lands.

Of agricultural public lands there are two classes: the one class at $1.25 per acre, which is designated as *minimum*, and the other at $2.50, or *double minimum*.

Title to these lands may be acquired by cash purchase, and in virtue of the pre-emption, homestead and other laws.

CASH PURCHASE (or Private Entry).

The person desiring to acquire land by this method will first present a written application to the register for the district in which the land desired is situated, describing the tract he wishes to purchase, and giving its area. Thereupon the register, if the tract is vacant, will so certify to the receiver, stating the price, and the applicant must then pay the amount of the purchase money.

The receiver will then issue his receipt for the money paid, in duplicate, giving to the purchaser a duplicate receipt. The register will then issue his certificate of purchase. At the close of the month the register and receiver will make returns of the sale to the General Land Office, from which, when the proceedings are found regular, a patent or complete title will be issued; and on surrender of the duplicate receipt such patent will be delivered, at the option of the patentee, either by the Commissioner at Washington or by the register at the district land office, Agricultural College scrip and land warrants can be used in locating lands at "private entry," but when so used are restricted to lands not mineral, which may be subject to private entry at $1.25 per acre, or in case of $2 50 land to half the number of acres called for by such scrip or warrant. They are also restricted to a technical "quarter-section"—that is, land embraced by the quarter-section lines indicated on the official plats of survey; or they may be located on a part of a quarter-section when such part is taken as in full for a quarter; but they cannot be applied to different subdivisions to make an area equivalent to a quarter-section.

PRE-EMPTION.

Title by pre-emption, to 160 acres, or to any legal subdivision of 160 acres of the public lands, may be obtained by actual settlement and residence thereon for six months, and the payment of $1.25 or $2.50 per acre, according as the land is minimum or double minimum.

The pre-emption privilege is restricted to heads of families, widows, or single persons over the age of twenty one, who are citizens of the United States, or who have declared their intention to become citizens, as required by the naturalization laws. This does not include Indians, except such as have ceased their tribal relations and been declared citizens by treaties or acts of Congress.

Further, no person who is the proprietor of 320 acres of land in any State or Territory, or who abandons his residence on his own land to reside on the public land in the same State or Territory, shall be allowed to pre-empt; and no person is entitled to more than one pre emptive right.

The following classes of lands are not, as a general rule, subject to the rights of pre-emption, to-wit:

First. Lands included in any reservation by any treaty, law, or proclamation of the President, for any purpose.

Second. Lands included within the limits of any incorporated town, or selected as the site of a city or town,

Third. Lands actually settled and occupied for purposes of trade and business, and not for agriculture.

Fourth. Lands on which are situated any known salines or mines.

Where the tract is "*offered*" land,—land that has been exposed for sale at public auction to the highest bidder,—the pre-emptor must file with the district land office his declaratory statement as to the fact of his settlement within thirty days from the date of said settlement, and within one year from date of settlement must appear before the register and receiver and make proof of his actual residence on, and cultivation of, the tract, and secure the same by paying $1.25 or $2.50 per acre, according to the class of land.

Where the tract has not been offered at public sale, the claimant must file his declaratory statement within three months from date of settlement, and make proof and payment within thirty months after the expiration of the three months allowed for filing his declaratory notice, or, in other words, within thirty-three months from date of settlement.

Should the settler die before establishing his claim within the period limited by law, the title may be perfected by the executor, administrator, or one of the heirs, by making the requisite proof of settlement and paying for the land; the entry to be made in the name of "the heirs" of the deceased settler; and the patent will be issued accordingly.

Before final proof is made on pre-emption claims and entry allowed, it is necessary that public notice be given under the act of Congress of March 3, 1879, as will be hereafter pointed out with regard to homesteading.

HOMESTEADING.

Under the provisions of the homestead law, title to 160 acres of the public lands may be acquired by five years' actual residence on and cultivation of the tract homesteaded, and the payment of certain merely nominal fees and commissions—never amounting to more than $26.00.

By statute, the homestead privilege is given to every citizen, and those who have declared their intention to become citizens of the United States. Former restrictions, limiting the homestead privilege to eighty acres of double minimum land, have, with respect to Missouri, been for the most part withdrawn; so that in this State there is generally no distinction made between the two classes of land with respect to this class of entries.

To obtain a homestead, the party must, in connection with his application, make an affidavit before the register or receiver that he is over the age of twenty-one, or the head of a family; that he is a citizen of the United States, or has declared his intention to become such;

and that the entry is made for his exclusive use and benefit, and for actual settlement and cultivation; and must pay the legal fee and that part of the commissions which is payable when the entry is made. Where a wife has been divorced from or deserted by her husband, so that she is dependent on her own resources for support, if in fact the head of a family, she can make a homestead entry as such.

Where the applicant has made actual settlement on the land he desires to enter, but is prevented by reason of bodily infirmity, distance or other good cause from personal attendance at the district land office, the affidavit may be made before the clerk of the court for the county in which the land is situated.

Upon faithful observance of the law in regard to settlement and cultivation for the continuous term of five years, and at the expiration of that time, or within two years thereafter, upon proper proof to the satisfaction of the land officers, and payment to the receiver of that part of the commissions remaining to be paid, the receiver issuing his receipt therefor, the register will issue his certificate, and make proper returns as a basis of a patent or complete title for the homestead.

Any settler, whether a pre-emptor or homesteador, desiring to make the final proof necessary to the completion of his title, must first file with the register of the proper land office a written notice of his intention to do so. Such notice must describe the land claimed, and the claimant must give the names and residences of the witnesses by whom the necessary facts as to settlement, residence, cultivation, etc., are to be established.

The filing of such notice must be accompanied by a deposit of sufficient money to pay the cost of publishing the notice to be given by the register.

Upon the filing of the notice by the applicant, the register shall publish a notice of such application once each week for a period of thirty days, in a newspaper which he shall designate, by an order written on said application, as published nearest the land described in the application, and he shall also post said notice in some conspicuous place in his office for the same period.

The notice to be given by the register must state that application to make final proof has been filed; the name of the applicant; the kind of entry, whether homestead or pre-emption; a description of the land; and the names and residences of the witnesses as stated in the application.

When proof is filed that notice has been given in the manner and for the time required by said act of Congress, the applicant will be entitled to make final proof.

In making such final proof, the homestead party may appear in person at the district land office, with his witnesses, and there make the affidavit and proof required in support of his claim; or he may proceed under the act of March 3, 1877. This prescribes that the party desiring to avail himself thereof must appear with his witnesses before the judge of a court of record of the county and State, or district and Territory, in which the land is situated, and there make the final proof required by the law, according to the forms prescribed, which proof, duly authenticated by the court seal, is required to be transmitted by the judge, or the clerk of the court, to the register and receiver, together with the fee and charges allowed by law.

The judge being absent in any case, the proof may be made before the clerk of the proper court. The fact of the absence of the judge must be certified in the papers by the clerk acting in his place.

Where a homestead settler dies before the consummation of his claim, the widow, or in case of her death the heirs, may continue settlement or cultivation, and obtain title upon requisite proof at the proper time. If the widow proves up, the title passes to her; if she dies before proving up and the heirs make proof, the title will vest in them.

Where both parents die, leaving infant children, the homestead may be sold for cash for the benefit of such children, and the purchaser will receive title from the United States; or the patent will issue to the infants on proof of settlement or cultivation for the prescribed period.

The sale of a homestead claim by the settler to another party before completion of title is not recognized by the General Land Office, and vests no title or equities in the purchaser.

When an individual has made settlement on a tract and filed his pre-emption declaration therefor, he may change his filing into a homestead, if he continues in good faith to comply with the pre-emption laws until the change is effected; and the time during which he has resided upon an claimed the land as a pre-emptor will be credited upon the period of residence and cultivation required under the homestead laws.

If the homestead settler does not wish to remain five years on his tract, the law permits him to pay for it with cash, or warrants, or agricultural college scrip, upon making proof of settlement and cultivation for a period of not less than six months from the date of entry to the time of payment.

All lands obtained under the homestead laws are exempt from liability for debts contracted prior to the issuing of the patent therefor.

For homestead entries on lands in Missouri, commissions and fees are to be paid according to the following table:

Acres.	Price per Acre.	COMMISSIONS.		FEE.	Total of Fee and Commissions.
		Payable when entry is made.	Payable when certificate issues.	Payable when entry is made.	
160	$2 50	$8 00	$8 00	$10 00	$26 00
80	2 50	4 00	4 00	5 00	13 00
40	2 50	2 00	2 00	5 00	9 00
160	1 25	4 00	4 00	10 00	18 00
80	1 25	2 00	2 00	5 00	9 00
40	1 25	1 00	1 00	5 00	7 00

SOLDIERS' HOMESTEADS.

A Union soldier or sailor of the late war is entitled to a deduction from the five years, of the length of time (not exceeding four years) of his military service. A soldier discharged on account of wounds or disability incurred in the line of duty, is entitled to the benefit of his whole term of enlistment, provided it does not exceed four years; and the widow or minor children of a soldier who died in the service are similarly privileged. But the soldier (or his widow, as the case may be) must actually reside on the land at least one year before final proof can be made.

In case of the death of the soldier, and the death or re-marriage of the widow, the minor children of the soldier, by a duly appointed guardian, are entitled to the privileges of the father.

Neither the guardian nor the minor children are required to reside upon the land, but the same must be cultivated and improved for the period of time during which the father would have been required to reside upon the tract.

The soldier may file a declaratory statement for a tract of land which he intends to enter under the homestead laws. The fee in Missouri is $2.00.

This statement may be filed either personally or by an agent, and the soldier is thereafter allowed six months within which to make his entry and commence his settlement and improvement.

The entry can be made only by the soldier in person at the local land office, and he must commence his settlement on the land within six months after his filing, and must continue to reside on the land and cultivate it for such period as, added to his term of military service, will make five years. But he must actually reside upon the land at least one year, whatever may have been the period of his military service.

Soldiers are not entitled to land, nor to bounty land warrants, for their military service in the late war, nor can title to land be obtained for them by agents or attorneys. All representations to the contrary are false, and soldiers and sailors are warned against imposition by parties who offer to locate land for them, or to sell their rights.

The "*Timber Culture Act*" does not apply to Missouri.

RAILROAD STATISTICS.

The following statistical facts concerning the railroads of the State have been taken, by permission, from the Tenth Annual Report of the Railroad Commission of Missouri:

NEW ROAD OPENED IN 1884.

The number of miles opened in 1884 is 131.05, as follows:

Railroads.	Miles.
Cape Girardeau Southwestern, to Wappapello	12.00
Chicago, Burlington & Kansas City, to Bogard	20.90
Des Moines, Osceola & Southwestern, to Cainsville	9.00
Kansas City & Southern, to Lowry	10.90
Kansas City, Springfield & Memphis, Burnham branch	9.00
Kansas City, Springfield & Memphis, Willow Springs	5.00
Mill Springs, Current River & Barnesville	5.28
Missouri Pacific, Lebanon branch, to Bagnell	5.00
St. L., I. M. & Southern, Jackson branch	16.00
Springfield & Northern	38.87
Total	131.05

[The number of miles opened in 1885 is, in round numbers, 260 miles.]

MILES IN OPERATION AT CLOSE OF YEAR 1884.

	Miles.
Reported at close of 1883	4,615.56
Add new lines built in 1884	131.05
Deduct corrections of measurements	5.21
Miles in operation at close of 1884	4,741.40
[Miles in operation at close of 1885 is, in round numbers, 5,000.00]	

The item of "corrections of measurement" is introduced to cover discrepancies in length of lines. Many of them are never reported to be of same length for any two successive years.

GAUGE.

The number of miles of three feet gauge at close of 1883 was 195.75. During the year 1884 the St. Joseph & Des Moines, 49.90 miles long, was changed to standard gauge, leaving 145.85 miles old line of three feet gauge. To these add the Des Moines, Osceola & Southwestern, 9 miles; the Mill Springs, Current River & Barnesville, 5.28 miles; and the Willow Springs branch of K. C., Springfield and Memphis, 5 miles, new lines, and it makes the number of miles of narrow gauge at close of 1884 to be 165.13, as follows, all other roads being standard gauge.

Narrow Gauge Railroads.	Miles.
Des Moines, Osceola & Southwestern	9.00
K. C., Springfield & Memphis, Willow Springs branch	5.00
Mill Springs, Current River & Barnesville	5.28
St. Joe Lead Mines Co.'s railroad	13.00
St. Louis, Cable & Western	16.00
Sedalia, Warsaw & Southern	42.25
Texas & St. Louis	74.60
Total	165.13

PROGRESS OF CONSTRUCTION.

The number of miles of road in use at close of each year since construction was commenced is shown in the following table:

Year.	Miles.	Year.	Miles.	Year.	Miles.	Year.	Miles.
*1851...	0	1861	838	1871......	2,580	1881......	4,234
†1852....	5	1862.....	838	1872......	2,673	1882......	4,501
‡1853....	37	1863.....	868	1873......	2,858	1883......	4,615
1854....	37	1864.....	925	1874......	2,880	1884......	4,741
¶1855...	140	1865.....	925	1875......	3,050	1885......	5,000
1856....	144	1866.....	925	1876......	3,140		
1857....	318	1867.....	1,055	1877......	3,190		
1858....	547	1868.....	1,354	1878......	3,250		
1859....	724	1869.....	1,712	1879......	3,617		
1860....	817	1870.....	2,000	1880......	4,007		

*Construction commenced on Mo. Pacific July 4th.
†Passenger car run to Cheltenham, 5 miles.
‡Mo. Pacific opened to Pacific, 37 miles.
¶Gasconade disaster November 1st.

DISTRIBUTION IN COUNTIES.

The number of counties in the State (counting the city of St. Louis as one), is 115. In the year 1878, there were 31 counties entirely unprovided with railroad transportion. At the close of 1884, the number had been reduced to 15, viz.: Carter, Cedar, Dallas, Douglas, Hickory, McDonald,Maries, Ozark, Perry, Pemiscot, Reynolds, Ste. Genevieve, Shannon, Stone and Taney,

We now have a mile of railroad to every 13¾ square miles of territory, and to every 500 inhabitants,

EARNINGS AND EXPENSES.

The total gross earnings inside the State, so far as the same can be separately ascertained, amount to $29,178,828, equal to $6,259 per mile of road operated. The total expenses amount to $17,347,678, equal to $3,721 per mile of road, and to 59$\frac{45}{100}$ per cent. of gross earnings. The net earnings amount to $11,831,150, equal to $2,537 per mile of road, and to 40$\frac{55}{100}$ per cent. of gross earnings.

The following table shows total earnings and earnings per mile of road per each year since 1875:

Year.	Total Earnings.	Earnings per mile.
1875	$15,826,450	$5,189
1876	15,271,235	4,865
1877	14,932,390	4,681
1878	15,525,500	4,844
1879	19,374,126	5,357
1880	22,411,644	5,593
1881	26,839,328	6,339
1882	27,616,659	6,305
1883	28,754,335	6,343
1884	29,178,828	6,259

EDUCATIONAL STATISTICS.

PERMANENT SCHOOL FUNDS.*

STATE SCHOOL FUND.

The amounts to the credit of the permanent State School Fund are as follows:

Certificate of indebtedness at 6 per cent	$2,909,000 00
Certificate of indebtedness at 5 per cent	224,000 00
In treasury to credit of State School Fund	1,171 15
Total amount to the credit of the "Public School Fund"	$3,134,171 15
University or "Seminary Fund"	514.095 08
Total of "Seminary Fund" and "Public School Fund"	$3,648,266 23

By an act of the General Assembly, in 1883, all money accruing to the Seminary Fund or Public School Fund, is converted into a certificate of indebtedness, payable in twenty years, and bearing interest at the rate of five per cent. per annum, payable semi-annually on the first days of January and July.

State Public School Fund	$3,134,171 15
State Seminary Fund	514,095 08
County Public School Fund	3,280,271 44
Township Public School Fund	3.304,009 48
Special Public School Fund	89,794 62
Fines, penalties, forfeitures, etc	152,992 32
Total School Fund of Missouri	$10,475,334 09

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*From the Report of the Superintendent of Public Schools for 1885.

The State funds can be increased only by "grant, gift, devise," or appropriation by the General Assembly.

The "County Public School Fund" is annually increased by the net proceeds of "fines, penalties, forfeitures, estrays" and the sale of swamp lands.

The "Township Public School Fund" is increased by the sale of such part of the sixteenth section as may yet be in the market and still held in trust for the township.

"Special funds" are such as have been secured by grant, gift, devise or special legislation.

The following table, compiled from the Report of the Superintendent of Public Schools for 1884, exhibits the value of the school property of each county; the amount alloted by the State to each county, in 1884, for school purposes; the amounts of the county, township and special public school funds, with their total for 1884; the total of the same funds in 1879; and a comparison of the two totals.

EDUCATIONAL STATISTICS.

COUNTIES.	Value of school property.	State aid to schools in 1884.	Township funds.	County funds.	Special funds.	Total of all funds in 1884.	Total of all funds in 1879.	Increase in five years.
Adair	$52,500	$4,151 70	$18,252 18	$41,818 31	....	$60,070 49	$53,054 89	$7,015 60
Andrew	77,500	4,502 80	17,512 88	47,052 86	....	64,565 74	63,012 39	1,553 45
Atchison	70,000	3,804 07	45,009 86	89,393 41	....	134,403 24	133,002 08	1,401 16
Audrain	53,445	5,381 40	36,919 75	15,754 93	....	52,674 68	45,188 98	7,485 70
Barry	50,000	4,879 95	12,978 86	8,143 70	$606 10	21,788 66	15,432 79	6,355 87
Barton	60,000	4,309 20	30,778 55	72,193 01	....	102,971 56	85,816 51	17,155 05
Bates	112,201	7,992 15	50 095 65	52,822 18	....	102,917 83	92,437 00	10,480 83
Benton	16,500	3,764 95	24,100 00	12,753 00	....	36,853 00	19,354 60	18,498 40
Bollinger	15,130	3,202 00	7,150 00	26,934 56	210 68	34,295 23	32,644 00	1,651 24
Boone	66,987	6,887 35	34,266 32	16,613 98	....	50,880 30	44,193 43	6,686 87
Buchanan	200,990	14,591 40	26,466 22	37,393 72	....	63,859 94	57,673 04	6,186 90
Butler	6,230	1,828 60	5,744 78	9,951 06	....	15,695 84	7,991 61	7,774 23
Caldwell	83,503	3,807 90	19,235 43	40,547 54	....	59,782 97	56,634 57	3,148 40
Callaway	51,246	5,970 70	41,528 24	6,627 46	1,461 58	49,617 28	45,283 35	4,333 93
Camden	5,550	2,224 45	9,280 80	13,463 80	....	22,744 60	17,632 35	5,112 25
Cape Girardeau	38,525	5,624 05	19,378 40	30,000 53	....	49,378 93	46,263 45	3,115 48
Carroll	91,601	6,497 75	32,892 97	49,775 29	....	82,668 26	81,783 33	984 93
Carter	1,360	598 10	....	....	....	....	579 34*	579 34
Cass	64,966	6,042 55	39,253 21	66,028 01	3,200 00	108,481 22	89,023 37	19,457 85
Cedar	40,128	3,865 70	8,086 25	29,492 40	....	37,578 65	30,865 27	6,713 38
Chariton	49,980	6,841 20	36,025 21	109,760 15	10,807 62	156,592 98	109,025,66	47,567 32
Christian	11,054	3,131 00	8,000 00	5,000 00	....	13,000 00	9,596 08	3,403 92
Clark	43,785	4,117 10	24,467 86	26,683 60	....	51,151 46	47,131 99	4,019 47
Clay	44,770	4,124 10	30,679 52	7,438 95	10,929 71	49,097 73	45,100 77	3,996 96
Clinton	55,632	4,546 55	19,513 16	13,990 15	....	33,503 31	29,256 99	4,246 32
Cole	54,132	4,205 35	27,414 50	7,950 91	....	35,365 41	32,991 26	2,374 15
Cooper	75,640	5,289 80	25,515 73	7,397 03	14,069 42	46,982 18	45,337 01	1,645 17
Crawford	24,000	3,182 50	15,269 15	2,455 53	....	17,724 68	14,322 73	3,401 95
Dade	24,227	3,897 70	19,001 06	7,043 28	....	26,044 34	16,788 14	9,255 80
Dallas	21,672	2,956 05	....	18,400 00	200 00	18,600 00	16,338 55	2,261 45

Dayiess	86,000	5,554 55	17,928 76	53,967 61	....	71,896 37	61,555 91	10,340 46
DeKalb	29,259	3,795 40	17,080 00	5,628 00	15,144 00	37,852 00	37,151 38	700 62
Dent	17,000	2,967 00	10,700 50	4,180 75	....	14,881 25	11,635 18	3,246 07
Douglas	6,400	2,783 50	2,000 00	3,660 62	....	5,660 62	3,394 32	2,266 30
Dunklin	1,000	2,657 55	6,492 92	2,361 82	....	8,854 74	1,062 00	7,792 74
Franklin	49,348	8,285 75	38,833 97	26,549 23	....	65,383 20	56,459 90	8,923 30
Gasconade	29,646	3,131 75	14,492 91	7,865 75	....	22,358 68	20,307 49	2,051 19
Gentry	59,782	5,281 25	15,357 90	64,296 19	....	79,654 09	76,668 14	2,985 95
Greene	96,925	8,942 40	19,085 84	24,684 26	....	43,720 10	38,437 35	5,282 72
Grundy	105,800	4,399 00	14,435 88	32,877 08	....	47,312 66	37,635 78	9,676 88
Harrison	63,995	6,059 70	30,811 16	59,112 95	....	89,924 11	82,412 14	7,511 97
Henry	56,080	6,437 60	24,186 50	22,242 51	....	46,429 01	40,845 23	5,383 78
Hickory	9,407	2,250 25	7,770 19	11,222 50	....	18,992 69	18,519 50	473 19
Holt	82,643	4,335 75	11,971 90	66,170 33	9,778 69	88,120 92	77,730 87	10,390 05
Howard	39,650	4,302 15	15,248 69	7,955 29	....	23,203 98	21,238 39	1,965 59
Howell	8,900	3,390 20	10,693 98	3,189 10	....	13,883 08	2,676 28	11,206 80
Iron	16,140	2,203 40	16,747 31	7,071 43	....	23,818 74	10,097 14	12,721 60
Jackson	540,640	22,272 05	20,902 01	101,973 46	5,230 61	128,106 08	95,350 00	32,756 08
Jasper	179,700	9,681 00	34,366 15	170,411 73	22,433 60	227,211 08	224,935 03	2,276 05
Jefferson	63,135	5,463 95	26,051 65	11,694 21	....	37,745 87	38,829 40	*1,083 53
Johnson	140,000	7,621 30	20,566 92	59,076 67	....	89,643 59	89,819 56	*175 97
Knox	32,000	3,551 05	21,766 45	41,013 84	....	62,780 29	57,438 31	5,341 98
Laclede	41,256	3,643 15	7,329 83	10,025 19	....	17,355 02	11,842 75	5,512 27
Lafayette	51,285	7,014 60	32,962 20	60,521 35	....	93,483 55	86,119 70	7,363 85
Lawrence	60,066	5,307 05	18,958 86	7,502 47	....	26,461 33	21,841 74	4,619 59
Lewis	46,800	4,069 50	18,656 88	14,488 04	6,154 79	39,299 71	32,913 73	6,385 98
Lincoln	35,000	4,620 70	24,236 36	2,910 03	....	27,146 38	28,993 88	*1,847 50
Linn	98,000	5,627 15	17,213 79	41,030 16	....	58,243 95	52,843 11	5,400 84
Livingston	95,285	5,745 05	23,704 03	100,835 53	232 79	124,772 35	124,928 43	*156 08
McDonald	10,000	2,827 25	4 448 72	5,816 73	....	10,265 45	7,871 11	2,394 34
Macon	68,799	7,349 60	28,386 39	54,060 64	5,427 36	87,874 39	85,360 31	2,514 08
Madison	11,00[illegible]	2,332 20	8,408 70	865 31	....	9,274 00	8,448 19	825 81
Maries	12,134	1,877 00	3,642 50	5,106 43	....	8,748 93	5,818 44	2,930 49
Marion	101,200	6,416 55	35,352 32	12,535 11	....	47,887 43	46,670 08	1,217 35

EDUCATIONAL STATISTICS.—Continued

COUNTIES.	Value of school property.	State aid to schools in 1884.	Township funds.	County funds.	Special funds.	Total of all funds in 1884	Total of all funds in 1879.	Increase in five years.
Mercer	$ 53,150	$4,074 15	$10,885 80	$34,138 52		$ 45,023 82	$ 37,522 40	$ 7,501 42
Miller	11,258	3,244 49	16,431 93	9,649 52		26,081 45	32,404 37	*6,322 92
Mississippi	8,000	1,939 35	1,532 85	141 39		1,674 24	11,406 85	*9,732 61
Moniteau	65,649	3,887 55	24,300 00	9,977 44		34,277 34	26,412 34	7,865 10
Monroe	49,892	4,955 65	29,954 27	80,625 65		110,579 92	106,899 97	3,679 95
Montgomery	35,340	4,028 90	16,369 82	3,835 15	$ 1,208 13	21,413 10	17,626 92	3,788 18
Morgan	13,000	2,778 05	18,909 33	5,731 13	1,056 22	25,696 68	23,044 98	2,651 70
New Madrid	3,900	1,898 10	3,330 00	6,937 87		9,267 87	2,881 80	5,386 07
Newton	44,410	5,510 80	13,842 00	8,570 00	2,761 80	25,163 80	21,423 99	3,739 81
Nodaway	160,000	8,817 45	25,607 77	76,882 87		102,490 64	93,343 15	9,147 49
Oregon	5,800	2,222 90	5,460 25	605 20		6,065 45	3,144 21	2,921 24
Osage	21,820	3,568 20	12,797 69	15,892 72		28,690 41	26,506 59	2,183 32
Ozark	4,838	1,866 85	2,211 38	3,350 56		5,561 94	2,708 41	2,853 53
Pemiscot	1,000	1,083 75	5,530 64	3,993 39		9,523 93	15,710 95	*6,187 02
Perry	16,320	3,008 40	18,443 72	8,160 25		26,603 97	29,284 50	*2,680 55
Pettis	120,540	7,561 15	21,749 36	19,376 99	1,261 56	42,387 91	35,868 67	6,519 24
Phelps	43,430	3,956 30	13,669 38	4,880 78		18,550 16	17,363 62	1,186 54
Pike	46,500	7,821 95	11,352 57	23,478 40		34,830 97	37,583 57	*2,754 60
Platte	36,100	4,726 95	20,200 00	4,630 54		24,830 54	21,143 05	3,686 59
Polk	38,766	4,726 10	9,457 63	38,895 00		48,352 63	40,173 15	8,179 48
Pulaski	10,000	2,291 65	6,820 68	6,446 95		13,267 62	8,330 99	4,945 63
Putnam	37,560	3,965 60	13,410 55	26,712 96		40,123 51	44,820 40	*4,696 89
Ralls	36,900	3,383 95	29,820 95	3,696 30		33,579 25	20,227 32	3,351 93
Randolph	60,105	5,977 75	21,532 20	16,151 57		37,683 77	34,743 34	2,540 43
Ray	47,560	5,482 70	33,467 25	38,433 05	1,390 81	73,291 11	58,269 81	15,021 30
Reynolds	3,564	1,577 20	3,701 04	2,922 81		6,623 81	4,554 74	2,069 07
Ripley	6,000	1,617 00	360 28	1,498 28	3,219 24	5,077 80	240 38	4,837 42
St. Charles	101,884	6,014 61	41,137 75	21,256 31		62,394 06	60,707 58	1,646 48

St. Clair	29,832	4,472 35	12,948 00	32,619 70		45,567 70	40,585 50	4,982 20
St. Francois	34,555	3,743 10	23,808 27	7,171 50		30,978 77	28,428 27	2,550 50
Ste. Genevieve	28,901	2,953 75	12,677 16	3,663 30		16,339 76	14,451 40	1,888 36
St. Louis	125,000	8,183 45	56,662 16	14,339 69	13,000 00	84,001 85	53,642 71	30,359 14
Saline	105,000	8,578 55	31,559 89	118,549 62		150,109 51	129,118 43	20,991 08
Schuyler	40,468	2,996 70	7,410 95	34,269 48		41,680 43	37,432 80	4,247 63
Scotland	34,000	3,424 55	10,227 83	35,157 10		45,384 93	43,131 16	2,253 77
Scott	8,000	2,288 50	9,423 87	6,289 76		15,713 63	11,473 98	4,239 65
Shannon	4,000	1,119 65	4,580 60	480 00		5,060 60	3,041 80	2,018 80
Shelby	52,118	3,971 90	21,969 61	30,457 91		52,427 52	48,407 03	4,020 49
Stoddard	12,681	3,815 75	9,721 91	7,732 02		17,453 93	9,743 57	7,710 36
Stone	9,294	1,264 10	3,011 97	1,796 73		4,808 70	3,326 77	1,481 93
Sullivan	38,000	4,841 70	16,339 78	35,092 59		51,432 37	47,922 91	3,509 46
Taney	1,270	1,560 80	2,076 06	3,841 00		5,917 06	5,621 18	295 88
Texas	18,000	4,096 80	8,389 00	743 97		9,132 97	6,573 00	2,559 97
Vernon	94,460	7,069 25	24,416 90	59,194 88		83,611 78	73,314 13	10,297 65
Warren	11,101	2,945 15	16,261 45	190 66		16,452 11	17,417 13 *	965 02
Washington	11,622	3,504 95	26,687 76	10,632 71		37,320 47	35,684 68	1,635 79
Wayne	24,618	2,500 10	3,664 82	3,590 83	549 86	7,805 51	4,278 27	3,527 24
Webster	42,678	4,032 80	6,340 71	15,738 24		22,078 95	16,313 59	5,765 36
Worth	44,000	2,501 65	6,382 05	18,748 20		25,130 25	21,344 93	3,785 32
Wright	3,600	3,327 75	7,221 80	22,390 02		29,611 82	17,510 51	12,101 31
St. Louis city	3,048,630	83,024 18	1,247,285 69			1,247,285 69	1,328,531 07 *	81,245 38
Totals	$8,825,548	$602,295 93	$3,347,260 11	$2,934,253 28	$130,637 87	$6,411,951 26	$5,835,252 07	$576,699 19

* Decrease.

REVIEW OF CROP REPORTS.

The crop reports inaugurated by the State Board of Agriculture, for the season of 1884, with very limited funds to prosecute them, have been carried forward more fully for the season of 1885.

The appropriation, by the State, of an increased sum for the work made this possible, although this sum is still inadequate.

The first report of the season was issued April 1st. At that time wheat was reported as quite unpromising; an acreage ten per cent. below the average had been reported the preceding fall.

The reasons assigned for the poor condition of wheat were as follows, to wit: First, late sowing, owing to excessive fall rains; second, unusually wet soil on flat undrained grounds; third, the influence of the Hessian fly on early sown wheat—this injury was very moderate; fourth, the cold, drying winds and the night freezes of March were very severe. The loss from freezing out was reported as greatest on the uplands, blown bare of snow. Early sown wheat was reported as looking better than late sown.

Hog cholera had swollen to an unusual extent, most of the counties reporting losses; and many very severe death rates.

A great fatality from cold weather was also reported; in fact, losses of cattle and sheep were stated to be due to this cause, and the fatality among hogs was constantly alluded to. This loss was unusually large in lambs, calves and pigs.

A very general interest has been developed in shelter as the result of these losses. This loss by cholera and death from exposure could be nearly, if not quite, obliterated, in the former case by proper diet and care, and about wholly obviated in the latter case. I estimate the loss of stock of all kinds for the State, for the past winter (1884–1885) to have been over $4,000,000, and believe that $3,000,000 of this would have been saved under proper management. Many counties reported a considerable purchase of calves from Ohio and eastward. An enormous loss of hay by bad stacking against a very rainy fall was reported. Peaches were killed, according to reports, and small fruits injured.

Reports of increased sowing of grass, clover and oats were noted, proving that our farmers are feeling their way to a wise change in their methods of farming.

Returns received during latter part of April from correspondents in every county except one, gave a wheat prospect for the whole State much more discouraging than that reported the month previous.

The remarks of correspondents showed that wheat was much more badly *winter-killed* than was at first anticipated. Roots that were supposed to have some vitality left, under the cold skies and wet soils of a rainy month, entirely disappointed the hopes before indulged in. In consequence 24.7 per cent. of the wheat was ploughed up. The acreage of grass and clover was reported as being 106 per cent. of that of 1884.

Every student of good farming can but note with pleasure the continued increase of the area in meadows noticed in the last two years. Let it go on until 50 per cent. or more of our farms are in meadows, in place of the 20 per cent. of last year, and of the 11.9 per cent. of a few years ago.

While the reports of probable increase of area of corn were manilest correct, yet it was evident that its period of seeding would be late. Complaints of a cold, wet month extended over most of the State. Counties in Southeast Missouri complained of drought, and some of them reported considerable seeding of corn. Taking the State as a whole but little corn was planted by May 1st.

Clover was reported as freezing out to a considerable degree, and pastures late in growth, and the grass not so good as in average seasons; hence cattle not thriving as well as usual, yet healthy.

A review of correspondents' remarks demonstrated our sheep husbandry to be in a languishing condition. Among the reasons assigned are tariff, or low priced wool, dogs and wolves.

In returns from all but three counties received during the latter part of May, considerable complaint was made of cheat, and the old offer was renewed to prove that wheat turns to cheat. Insects were reported as doing some damage, yet no more than usual, if as much.

A few of the counties mentioned the army worm, and two or three the Hessian fly.

The cold, wet spring and damaged seed-corn, due to prolonged fall rains, gave a very poor stand of corn, many farmers having to re-plant the second and third time.

In response to our enquiries regarding variety of corn most planted, reports were more indefinite than expected. The St. Charles white was mentioned more than any other variety, most persons reporting yellow or white, or yellow and white. In short, little attention is given to purity in seed-corn, and seed breeding for purity is less considered than stock breeding. An inspection of our corn in the State, in its form of ear, kernel and the stalk upon which the corn grows, with imperfections that can easily be remedied by careful attention to selection, and in the growth of selected ears by themselves, will reveal a great work to be done in this direction. The preserving of seed in dry quarters is a matter of very great moment, and for this year would have saved millions.

In the returns for the report issued July 1st, the complaint of too much rain was quite general, interfering with harvesting and haying, but more especially preventing the proper cultivation of corn, which, in consequence, was late and weedy. A frequent remark from the correspondents was: "Corn on low, flat land is drowned out; on well drained land it is good." This shows how much the farmers of Missouri would be benefited if the land was well under-drained.

In the southwestern part of the State, the web-worm was reported as doing considerable damage to the corn. No other insects were complained of, to any great extent.

Correspondents from about forty counties reported that the weather was too dry during the month of July, and about one-half that number from other counties complained of too much rain. These conditions of the weather were not sectional; the counties reporting both dry and wet weather were widely scattered throughout the State. But little complaint was made of insects, or of disease among stock.

The month of August brought drouth to some sections of the State, and particularly so to Southwest Missouri. In that section, and to a considerable extent in South Missouri, corn was reported materially injured by the dry weather. Other sections of the State complained of the ill effects of too much rain earlier in the season, for corn. During this season it became evident that wet grounds would give a poor return in corn, again demonstrating to our farmers the value of drainage, which would convert these farms into our best corn areas in large sections. There was a somewhat wide complaint of damage to corn and other crops by grasshoppers native to the State. They seem to have been most destructive north of the river.

The heavy decline in our sheep husbandry shown in the returns for August, is an important and unfortunate fact. I have no doubt of the profit of mutton and wool sheep under good care. They are not the animals for negligent husbandry. The figures given below are interesting. Of course they are but the estimates, not actual accounts of farmers, yet approximating a correct average. Fortunately they show a balance on the right side. South of the Missouri river the cost of keeping per head, per year, is $1.04 and the receipts $1.52. North of the river the returns are $1.25 cost, to $1.91 receipts. The superior care given sheep north of the river results in better net revenue. Such is the case in sheep husbandry.

The month of September was a normal one over most of Missouri in climatic conditions. Frost held off, and the usual warmth of September placed the corn crop in a safe condition.

Early September was too dry for plowing, and middle September covered nearly a week in which the soil was so wet from a heavy rain that sowing wheat or plowing was not to be thought of over a large area of Missouri. This delayed sowing, and in some parts of the State curtailed the area devoted to wheat.

Wet weather in their growing season curtailed the quantity and impaired the quality of the potato crop.

Apples, promising less than an average crop for some time, and curtailed in promise by free dropping, were reported in September returns at 65 per cent. of a crop.

Cholera was less alluded to than in previous months, although stil very fatal. The grasshopper extended its ravages into September while the drouth of South Missouri, of the early half of August, seems to have shifted to the north, as several counties in that section complained of its decided influence.

The question: "What plants, especially grasses, have been recently and successfully introduced into your county," elicited some response. Orchard grass was the most favorably mentioned of any plant of recent introduction—a dozen counties speaking well of it. Four report well of Johnson grass; three, Alfalfa; two, Alsike; two, English blue grass. German millet and Hungarian grass seem to be quite generally and favorably known.

The final returns for the year, received during latter part of October, from the Board correspondents, were the most full of the year, and embraced every county (114) and many returns from most of them, and were in response to 1050 circulars of inquiry.

Many facts of interest were embodied in the remarks of correspondents. The remarks of correspondents are always very much curtailed in the reports issued by this office on account of our restricted resources. The month of October was one of average rainfall and temperature. Under favorable atmospheric conditions the wheat crop looked promising and was reported at the high average of 96.6 per cent. of full condition. Its area was again reported as reduced by the price of wheat, the drouth of September and after rains. Indeed, there is manifested a steady determination to reduce the area of wheat and to increase that of clover and timothy. The move is a sound one. Under it Missouri will soon raise as much or more wheat than now and more stock, if the movement be attended with sound methods of rotation and increased use of the manures that will result from cattle feeding. Orchard grass was praised from many quarters. Drouth in South Missouri, too much rain on lands needing drainage in North Missouri and injury in shock gave for corn an estimated quality of 95.5 per cent. compared with the crop of 1884. Potatoes, usually suffering in quality in wet seasons, stand at 96.7 per cent. in quality compared with 1884. Not much complaint is made of potato rot. Sorghum suffered some from a wet season, and reported a syrup off in quality and yield.

On page 203 is given a summary of the harvest results for the year.

A look at these crops, as a whole, reveals a good round total of harvest results. Wheat may be off, yet corn is good, hay heavy, grazing has been fine and stock thrifty. Mast has been good, and other crops a fair average. Notwithstanding these facts, farmers are far from surveying the past year with satisfaction, for the following reasons, to-wit: A low price for a small wheat crop, a low price for corn and a heavy shrinkage in the value of all domestic animals to which it is fed. Sheep are heavily off in numbers and price; hogs are three cents a pound in the farm yard and below cost, as they are now fed. Cattle are 1¼c. in round numbers, or $16 to $22 per head for fat steers, off in value. To these animals most of the crops of the State are fed save the wheat crop, which is less than eight bushels per acre.

The following comparative results are submitted:

Sorghum—average quality, 90.0 per cent.
Tobacco—average quality, 89.0 per cent.
Apples—average yield, 65.0 per cent.
Oats—average quality, 94.0 per cent.
Broom corn—average quality, 90.0 per cent.
Hay—quality compared with 1884, 100.2 per cent.
Corn—quality compared with 1884, 95 5 per cent.
Irish potatoes—quality compared with 1884, 96.7 per cent.
Sweet potatoes—quality compared with 1884, 96.6 per cent.
Wheat—area sown compared with 1884, 90.3 per cent.
Wheat—present condition compared with average, 97.0 per cent.
Rye—area sown compared with 1884, 89.3 per cent.
Cotton—area compared with last census, or 1879, 102.8 per cent.

Sorghum—area compared with last census, or 1879, 104 per cent.

Beans—area compared with last census, or 1879, 84.6 per cent.

Flax—area compared with last census, or 1879, 78.9 per cent.

Hemp—area compared with last census, or 1879, 91.9 per cent.

Broom corn—area compared with last census, or 1879, 95.1 per cent.

Castor beans—area compared with last census, or 1879, 89.1 per cent.

I may mention grasshoppers, Hessian fly, hog cholera, black leg, army worm, wire worm, boll worm, chinch bug, quinsy, glanders (of considerable amount), and a few lesser evils. These, while reported as doing damage in varying degrees locally, summed up as a whole but little exceed the usual annual damage, yet the aggregate rises into millions for the year.

More than ordinary pleasure is here taken in publicly thanking correspondents for the public spirit manifested in their gratuitous and faithful reports. They have shown that the same public spirit exists on our farms that has given several of our sister States their admirable and praiseworthy crop reports.

CROP STATISTICS FOR 1884.

In the absence of proper legislative aid in the collection of crop-statistics, the Missouri Board of Agriculture has been obliged to base its crop reports entirely upon personal estimates instead of the surer foundation of assessor's returns, as in our sister States. While results for the State, taken as a whole, when arrived at in different ways, have been found to agree with a closeness very gratifying, and hence are believed to be quite reliable; yet it is feared that the results for counties, when taken separately, will often prove misleading. And this in accordance with the principle that the accuracy of the average of a number of estimates increases with the number of such estimates. Where this number is small, as in case of a county, errors may be looked for; where this number is very great, as in case of the State, the errors in individual estimates will probably cancel each other when such estimates are combined into one result.

In view of the foregoing facts it was thought preferable to omit the crop returns for the counties, and to present only those for the State taken as a whole. These are given in the following table:

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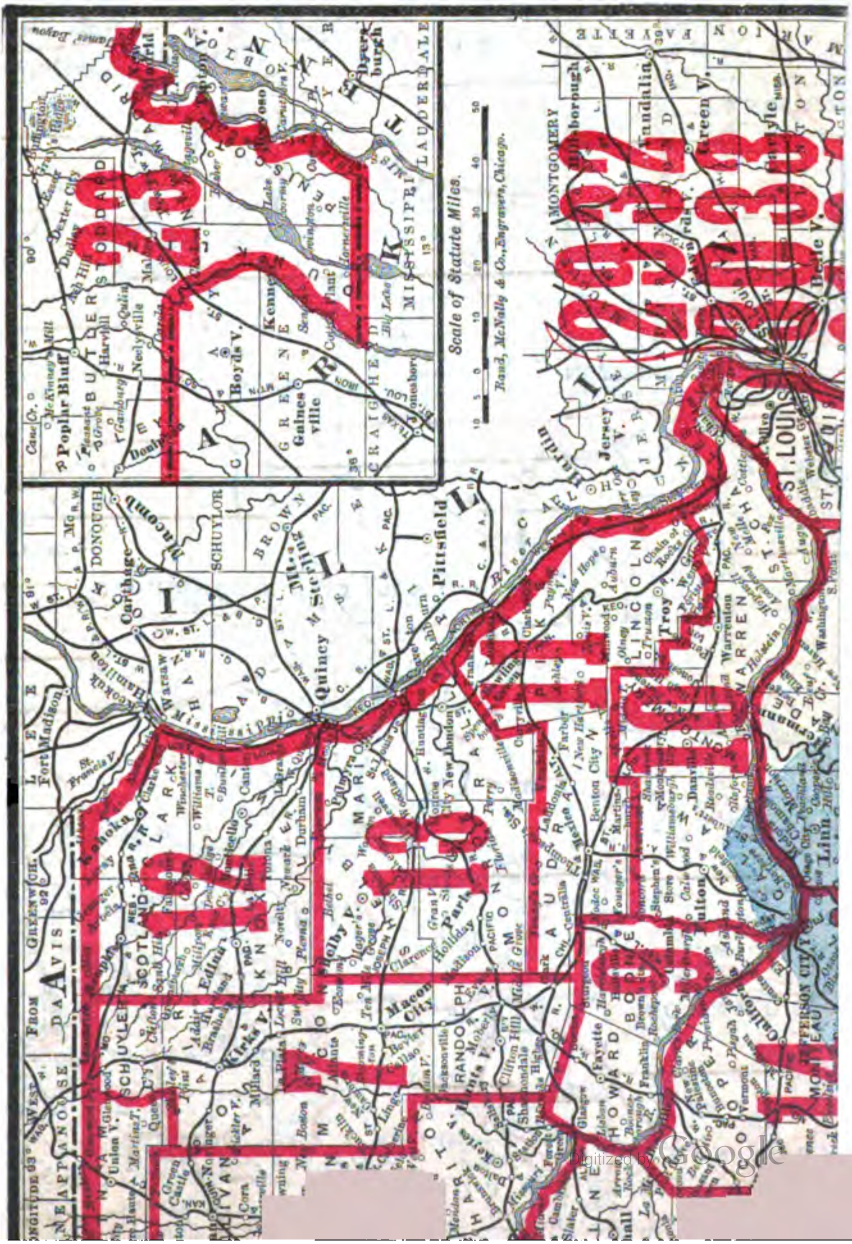
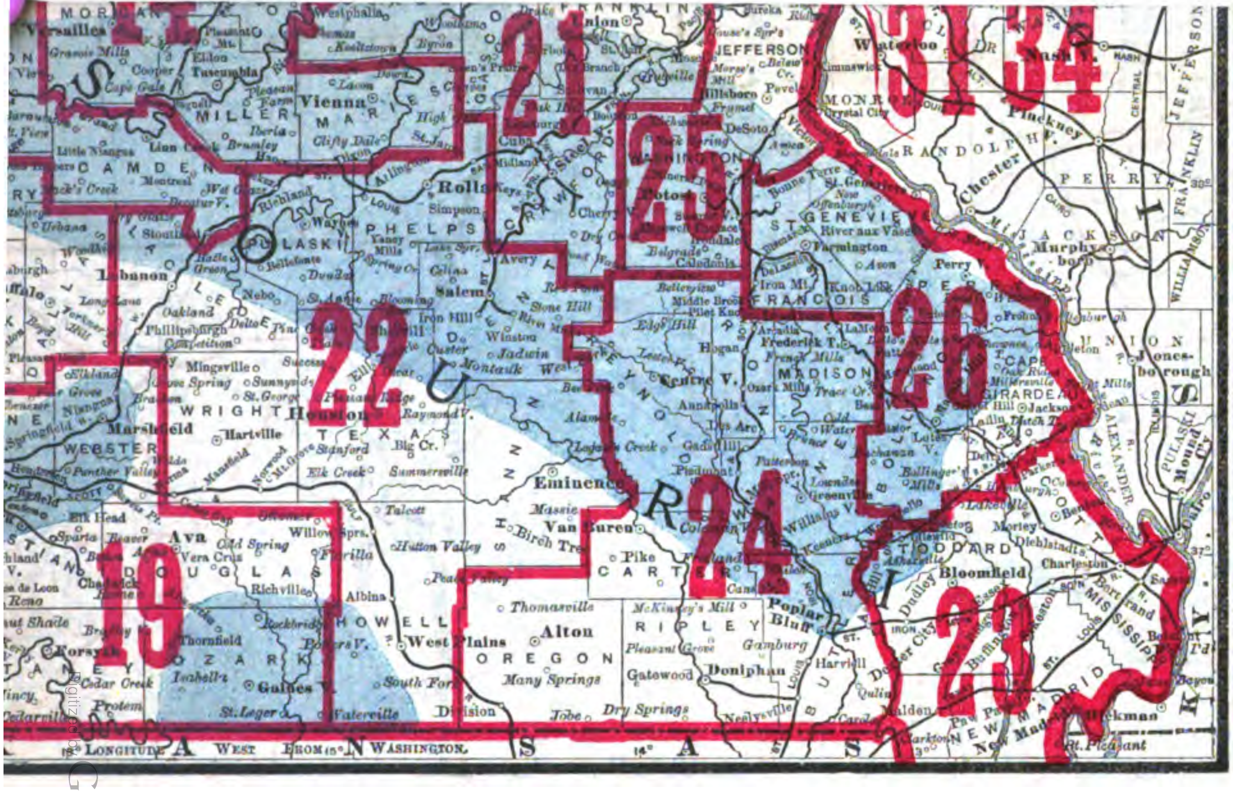
l Districts and Iron Regions of Missouri.



Scale of Statute Miles.

Rand, McNally & Co., Engravers, Chicago.



…on bearing Districts. Senatorial Districts.

MISSOURI STATE CROP STATISTICS FOR 1884.

Name of crop.	Total acreage.	Total yield.	Yield per acre.
Corn	6,229,772	190,008,046 bushels.	30.5 bushels.
Wheat (winter)	* 1,550,197	12,029,441 “	7.8 “
Wheat (spring)			11.4 “
Oats	1,202,177	31,857,700 “	26.5 “
Rye	49,544	544,984 “	11.0 “
Barley	7,006	140,120 “	20.0 “
Buckwheat	5,613	90,937 “	16.2 “
Cotton	33,045	22,450 bales.	0.68 bales.
Tobacco	14,876	12,867,740 pounds.	861.0 pounds.
Potatoes (Irish)	77,492	7,020,775 bushels.	90.6 bushels.
Potatoes (sweet)			89.7 “
Hemp			867.0 pounds.
Broom corn			926.0 “
Sorghum			101.8 gallons.
Flax			8.0 bushels.
Beans			15.0 “
Hay			1.5 tons.

* Area harvested.

NOTE.

The compilation of stock statistics was not completed in time for their insertion here. They will be found at the end of the Report.

RECENT PROGRESS OF CITIES OF MISSOURI.

Believing the development of our industrial centres to be an infallible index of the progress of the agricultural districts upon which they depend, the Secretary addressed letters to the Mayors of the several cities of the State, asking for information relative to the recent advancement of such cities in manufactures, population, wealth, railroad facilities, educational advantages, etc., etc.

In response, papers relating to Kansas City and Hannibal were furnished, and are here submitted to the public:

KANSAS CITY.

CUTHBERT POWELL,
Editor Kansas City Live Stock Record.

The value of a State's agriculture is not alone to be estimated by its mere crops. To be sure, they are an important and primary element in the farming interest. But the husbandman's labor are more far reaching than shown by these simple returns. How many cities owe their prosperity to the agricultural interest? Most of our western centres. And there is no surer indication of prosperity in any community than to find it surrounded by well tilled fields. Yet our Legislature persists in neglecting this most important of all interests, and men who are indirectly drawing their nourishment from it, fight all measures proposed for its advancement. A policy, we conceive, resulting more from ignorance than design. No one who knows anything can deny that Kansas City owes her prosperity to agriculture; and this, the busiest of all cities in the West, is a product of the fields and flocks. The palatial residences of our cattle kings, merchant princes and manufacturing capitalists all resulted, directly or indirectly, from agriculture, from which their owners draw their greatest support. And as this interest expands, our material growth must widen. In a country like ours, even art and literature are closely allied to the farm interest. Hence, there can be no better reflex of the advancement of a country's agriculture than the growth of its cities. Accepting this as a correct hypothesis, there has been a marked advancement in our agriculture in this part of the State during the last few years, in spite of the neglect of our legislators. In 1880, according to the National census, our city had a population of 58,985; and including Wyandotte, Kas., just across the Kaw river, 65,134. Now, according to census just taken, the population of Kansas City is 105,000; and including Wyandotte and the suburban town of Armondale, built up since 1880, the population may safely be placed at 120,000. In manufactures, we had in 1880 two packing houses, working about 700 men, whereas there are now five first-class houses in full operation, two of them the largest in the country, and a sixth is in course of erection. This industry now represents an investment of $7,000,000, and employs over 2,000 hands the year round, whose earnings will average $2.50 per day, and to whom is paid $1,565,000 annually. Most of these employes are men of family, and it is safe to say that the packing interest here furnishes support to 6,000 people. There were slaughtered at this point in 1880, 505,478 hogs, at a cost of $5,054,780; and 31,817 cattle, for which $1,554,510 were paid. For this year alone, from the 1st of January to October 1st, the number of hogs packed was 990,071, at a cost of $8,000,000, and number of cattle killed, 65,000, representing a moneyed value of $1,900,000, making $9,900,000 paid out for raw material alone, against $6,609,290 in 1880. A grand showing, and mighty tribute to the farm interest. But this is not all. The above is exclusive of the shipping trade, at the yards, in cattle, hogs and sheep, which furnishes employment to a good many men, and represents much money.

The stock yards now employ 185 men, and pay out annually $110,000 in wages, as contrasted with 75 men in 1880, and $60,000 paid in wages.

RECEIPTS OF LIVE STOCK AT THE STOCK YARDS.

	1880.	1884.	Increase.
Cattle	$244,709	$533,526	$288,817
Hogs	676,477	1,723,548	1,047,071
Sheep	50,611	237,967	187,356
Horses and mules	14,086	27,163	13,077

These figures make a most surprising exhibit. They show an increase of 118 per cent. in our cattle trade, 154 per cent. in our hog business, an increase of 370 per cent. in our receipts of sheep, and 92 per cent. in the receipts of horses and mules. In dollars and cents, this trade alone may be safely valued at $50,000,000 every year. Then our grain business for 1884 reaches 6,199,575 bushels of wheat, 7,298,287 bushels of corn, 185,522 bushels of oats and 144,281 bushels of rye. In 1880 the receipts of wheat were 4,093,528 bushels, corn 4,420,760 bushels, oats 366,492 bushels, and rye 65,267 bushels.

An interest in cereals, even at the present low prices, safely worth $7,000,000 per annum. These are primary interests. The secondary, such as our jobbing trade and manufacturies, are largely indebted to agriculture for their support. In the way of manufacturies we have grown much since 1880, and but for high rents a much further advancement would have been made. Our city now has eight iron foundries, boiler and machine works; fifty per cent. more than five years ago. These plants represent an investment of $350,000; and employ 325 hands, who earn $250,000 in wages every year.

One of the best linseed oil mills in the country is located here, employing a capital of $100,000, and working thirty men. It is the outcome of our agriculture, as it draws its flax seed and castor beans directly from the farmer, and sells much of its product oil-cake to feeders. It has extended its business 40 per cent. since 1880. There are many other minor interests which have put forth a wonderful growth the past five years. Perhaps, I cannot better illustrate the great strides of our commerce the past four years than by repeating our bank clearings. While they do not represent the full trade of a city they furnish a fair index:

	1889.	1884.	Increase.
Clearings	$50,600,000	$177,141,444	$126,541,444
Bank capital	1,400,000	2,700,000	1,300,000

Our bank clearings for 1885 will even exceed last year's, they having already reached, up to November 1st, $179,882,875 ; and our bank capital may now be placed at $3,000,000. This is a monstrous growth and a wonderful prosperity, all of which may be traced to agriculture, the field and farm.

If under the past neglect by our State government of its agricultural interests, it has enabled our citizens to produce such results, what might we expect if the farming interests should receive its due recognition, and fostering care of our State authorities? In neglecting agriculture, one, if not the greatest industry, the foundation of all others, is slighted. Without well tilled farms and healthy herds and flocks there can be no prosperous farmers, and without prosperous farmers there can be no well-to-do towns, and without well-to-do towns no flourishing cities, the jewels of a country, and promoters and encouragers of literature and art.

HANNIBAL.

F. W. Wyman,

President Hannibal Board of Trade.

Hannibal is the fourth city in Missouri as regards population. It is the center of six railroads, four of which terminate here, two passing through. It is situated on the Mississippi river, one hundred and eleven miles from St. Louis, sixty from Keokuk, two hundred and eighty-three from Chicago, and two hundred and twenty-six from Kansas City.

The following are among the prominent business transactions in Hannibal in 1882:

Lumber, feet	230,890,664
Value	$4,050,598 48
Drugs, paints and oils	2,139,000 00
Groceries	1,764,800 00
Flouring mills	1,304,300 00
Provisions	484,615 55
Sash, doors and blinds	256,572 29
Hard and soft coal	296,048 00
Meat markets	248,200 00
Lime manufacturing	192,000 00
Receipts and disbursements of postoffice	189,725 96
Total business of 1882	$19,573,724 48

Hannibal is the largest lumber market on the Mississippi river.

Fully 200,000 barrels of lime are annually manufactured here.

The city is supplied with a most admirable system of water and gas works, has street railway, telephone exchange, free letter delivery and letter boxes, fast mail from St. Louis, most excellent public schools, and religious societies of nearly all denominations.

Social attractions are of a superior character, and one of the very best opera houses in the State is to be found here.

Three fine brick school-houses were erected in the Spring of 1882, and $200,000 worth of building done during that year. Population 14,000.

PUBLIC SCHOOLS.

	1882–'83.	1883–'84.	1884–'85.
Enumeration	3,805	4,115	4,347
Enrollment	2,128	2,160	2,296
Teachers	33	34	34
Average daily attendance	1,332	1,434	1,473
Total per capita expenditure	$13.43	$12.77	$12.75
Total expenditure for all purposes	$20,286 05	$22,899 57	$23,694 18

The value of school property has been estimated at $58,700. By the erection of new buildings it has been increased to $75,000. The number of teachers for 1885-86 is 43.

REPORT OF THE STATE VETERINARIAN.

MISSOURI AGRICULTURAL COLLEGE,
(STATE UNIVERSITY),
COLUMBIA, November 28th, 1885.

PROF. J. W. SANBORN, DEAN, *Secretary Missouri State Board of Agriculture:*

DEAR SIR: In accordance with your desire, I submit to you, very respectfully, a few remarks regarding the health of live stock in the State of Missouri.

Since my appointment (April 21st, 1885) as Veterinary Inspector for this State, and as Professor of Veterinary Science at the Agricultural College, etc., I have visited in my official capacity the counties of Hickory, Nodaway, Atchison, Gentry, Harrison, Mercer, Putnam, Sullivan, Daviess, Andrew, Macon, Lewis, Clark, Chariton, Randolph, Pike, Lafayette, Howard, Bates, Livingston, Audrain and St. Louis. Some of them I had to visit two or three times. In many instances the disease proved to be non-contagious, and the people after being convinced by explanations and tests that there was no danger for the surrounding stock, felt very thankful, and they treated successfully many animals according to your servant's directions. I may mention for instance, the outbreak of skin disease which appeared among cattle in Harrison county a few months ago, and also several cases of what is termed "dry-murrain." In the first instances, two cases had died before treatment, but all the numerous remaining ones were cured. I have not as yet a very good record of all the animals treated successfully or otherwise under my advice, and it is rather a hard matter to get the facts. Very few treat their patients as directed. The first malady to which my attention was called in my official capacity was the cattle disease which broke out at Fulton, Callaway county, last winter. The outbreak was first reported to the Department of Agriculture at Washington, and Dr. Trumbower, Inspector of the Bureau of

Animal Industry, was sent to make an investigation. He and several other veterinarians of ability, among whom were Drs. Holcombe, of Kansas, and Hagyard, of Kentucky, diagnosed the disease "Contagious Pleuro-pneumonia." Some of those men had throughout the West the reputation of being thoroughly posted in their profession, and we had reason to rely upon their judgment.

As for me, I cannot add anything regarding contagious pleuro-pneumonia in Missouri to what I have stated already in my report on the subject to the Agricultural College in March last, and which was published at the time as Bulletin No. 15. I arrived on the grounds after all the cases which were said to be typical or diagnostic (*i. e.* well marked) had been killed. I did not see a case justifying an opinion from personal observations.

I found several cases of glanders among horses and mules in the counties of Hickory, Nodaway, Mercer, Putnam, Andrew, Atchison, Sullivan, Bates and Livingston; and a large number of cases were reported to me by several practical stock men and veterinarians of practical knowledge as having occurred in St. Louis, Kansas City, St. Joe, etc., etc.

To my personal knowledge, forty-three head of horses or mules have died from the effects of glanders in a more or less serious form as it appears in the West; or have been killed on account of that disease by the advice of your State Veterinarian, thus preventing a quarantine (the proprietors generally preferring absolute extermination to the latter proceeding).

In some doubtful cases I made tests in order to prove beyond a reasonable doubt what we had to deal with, because it is sometimes impossible to diagnose certain cases after one examination only. In every instance a large number had died before my visit. Three men—one in Kansas City, one in (or from) Lamar, Mo., and the other from St. Joe—were reported to have died from the effects of glanders taken from horses or mules.

There exists in several counties of the State a form of catarrhal disease of malignant nature among the equine race which often proves very fatal, particularly to mules. The disease sometimes has very much the aspect of glanders. The greatest care must be taken in inspection in order to find the difference, and occasionally it is prudent to see the cases *more than once* in order to be sure. As the law hardly gives me this privilege, such cases cause a great deal of anxiety to the proprietors, their neighbors and myself. But there is no alternative; I cannot condemn a case for glanders until I see its characteristic symptoms. I had great trouble frequently to convince parties that certain cases were not true glanders; inoculation had sometimes to be resorted to for that purpose.

Four outbreaks of the disease called *Texas fever*, *southern cattle fever*, *splenic fever*, *etc.*, have occurred to my personal knowledge in the State of Missouri, during the summer months, and several other outbreaks were reported from various points which I was not called to visit. Of these I of course, cannot say anything more than to mention them. I have just returned from Audrain county where another outbreak has occurred among cattle bought at the Kansas City stock yards by Mr. Green Gant, of Mexico. Thirty-eight head had died before my arrival, and ten or twelve were sick. The loss caused by this dreadful malady, although not so great as last year, is still very large. However, to my knowledge, no outbreak of this malady has happened among our cattle because of southern germ-bearing cattle being kept and fed any length of time within our borders, excepting at Kansas City, and perhaps at St. Louis. All the cattle which became affected were native or acclimated. When they get the disease they generally die, but do not communicate it to others, strange as it seems. In one instance, only, there were among the diseased herd a few cattle whose identity was doubtful, for that reason the entire herd was placed in quarantine and the malady went no further. This occurred in Lafayette county, near Odessa.

The principal other diseases among live stock, and to which my attention is frequently called, and advice is often requested, are symptomatic anthrax (black leg), and parasitic-bronchitis in calves, and that form of indigestion, commonly termed "dry-murrain" or "mad-itch" in cattle.

Many cases of so-called "hog cholera" and "fowl cholera" are said to have occurred throughout the State, but I regret to say, I am not in a position to explain much about them from personal observations, because I was never called officially when they happened, and my time was so taken up by other duties, as you are well aware, that I could not act voluntarily as often as I anticipated, and as I was very anxious to do. It seems from all I have learned that the financial loss to Missouri through this disease is enormous.

This much I may say, however, many cases of disease among hogs recorded as "hog cholera" are non-contagious affections which might be prevented if some qualified men in veterinary pathology had time and means to investigate the matter thoroughly. With respect to *swine plague*, *black leg*, *parasitic-bronchitis* and *dry-murrain*, it would undoubtedly be of great benefit to the State if they were better understood. There are so many erroneous statements published in regard to them that the agriculturalists and stock raisers hardly know what to think or what to believe. Most of what is published here and there comes from unreliable sources. Would it not be proper then to describe those maladies here? Trusting that you will agree with me in this, I shall proceed. I shall be as brief as possible, and will endeavor to be concise in my work. I will take council from the best modern German, French, English and American veterinary writers and practitioners. But first, a few words in regard to those apparently malignant catarrhal troubles among horses and mules, and to which I have already alluded. They may be termed *acute* and *chronic catarrh*, *croup* of the *nasal mucous membranes*, and *diphtheritis* of the *pituitairy*, (Roll.)

The two first forms of catarrh may occur in several horses or mules at the same time in one locality, but the disease is not contagious, it is due to one or several influences acting on all the subjects.

Croup and diphtheritis are pronounced contagious by actual contact of the discharge from the nose of a diseased subject (horse or mule) with the nasal mucous-membrane of a healthy one. I have seen reliable indications of this. For this reason those affections have, I think, frequently been confounded in this country with *glanders* or *farcy*. It is perhaps true, as some able veterinarians claim, that glanders may result from them, but if it is true, it does not occur very often. I have tried several times to produce glanders by careful inoculation of proper subjects with virus from horses pronounced by ordinary observers and even by educated veterinarians as suffering from glanders, and I failed every time. Indeed diphtheritis, and even croup, are described by some as real glanders in the acute form. Few English or American veterinarians make any difference in describing them. Yet while we may produce septicemia (or blood poisoning) with the poisonous matter of these diseases, we cannot produce chronic glanders. If any connection exists between the nature of these maladies, it is perhaps that croup or diphtheritis in the horse specie may, under certain favorable conditions, cause the glanders virus to generate itself within the animal system. All this remains to be proved; I doubt it.

Practically, this professional controversy does not change the situation so far as the public and particularly the stock raisers are concerned, for these maladies are often as deadly and perhaps as bad in every respect as glanders itself. Perhaps eighty per cent. of the cases which apparently recover are never cured entirely; about fifty per cent. die within three months to three years, and all those which live for any length of time with the disease are usually, if not always, objects of disgust and of terror to the proprietors and their neighborhood.

Especially in mules, as I have said, I have noticed the fatal results. Some cases, however, may be cured in the beginning by such treatments as are indicated in Bulletin No. 16 of the Agricultural College for animals suspected of glanders.

It matters not in my opinion what name a disaese bears, if it is most always fatal, if it is contagious and rarely curable without very great trouble and expense (sometimes equal to the value of the animal), one might as well destroy the patient at once.

Whenever a horse or mule begins to run at the nose, the matter being more or less thick, whitish, or yellowish, or green, or bloody, and adhering to the nostrils around their openings; when there is a moderately hard swelling (which very seldom breaks) under the lower jaw between its two branches; and when ulcers or sores seem to form in the nasal cavities, it is always good policy, indeed it is a duty you owe to yourself and the community to immediately place the affected animal in an isolated place where no healthy one of the same species can get to it. The law can force you to do this. In summer let such animals be kept by themselves in a small, good isolated, pasture, with high fences; and in winter shelter them separately, and keep them entirely by themselves, on soft, nutritious food. Take care that you do not get any matter on sores or in your eyes; it is a prudent thing to act thus in all suspicious cases. And if by proper means instituted in the beginning you cannot succeed in effecting a cure, and the patient gradually grows worse, and you see ulcers in the nose, take its life in the most humane way possible. You will save money by it and do a kind act to the brute. The reckless manner in which many such cases are treated is really painful to consider. No wonder so many animals become affected. In addition to the treatment of catarrhs of the head, as precribed in Bulletin No. 16, it may be useful to inject twice a day in the nostrils with a syringe, a spray, or nasal douche instrument, a solution of sulphate of zinc or of iodide of potassium, ten to twenty grains to an ounce of water. Some benefit may also be derived from inhalations of carbolized vapors. To accomplish this, take a quart or two of wheat bran, sprinkle about one dram of pure carbolic acid over it and scald the whole with boiling water. Then empty the bran into a coarse bag and keep it for about thirty minutes under the nose of the patient. The bag may be kept in position by means of straps or ribbons of cotton cloth tied to the halter or over the head. Care must be taken to allow sufficient air to penetrate the bag and enter the lungs during this process. Renew the operation every six or eight hours or at least twice daily. True cases of glanders may be palliated but are never cured entirely. (For differences of symptoms and diagnosis of glanders see Bulletin 16 referred to in this writing).

SWINE PLAGUE.

This affection also called "hog cholera," swine fever, charbonous gastro enteritis, etc., is considered a contagious one, both by direct contact and through the air.

SYMPTOMS.—Dulness, carelessness, love of cold drinks, apparent dislike of solid food, desire to hide under bedding, slow and difficult walking, ears hot and sore, tail hanging, eyes sunken, inside of eyelids red, flanks painful by pressure, heart fast, pulse small and rapid, respiration quickened. After twelve to twenty-four hours, or perhaps longer, these symptoms are more pronounced. There are sometimes tremblings; the body becomes hotter and is pained by the touch, especially the belly where pressure causes the patients to scream. Sometimes they scream plaintively without being touched. The hind extremities become unsteady, vacillating; there is constipation or bloody diarrhea and the animal gradually weakens. Finally the pulse becomes imperceptible, the beating of the heart weaker, the body cooler, the victim is stretched on the bedding, it is occasionally agitated by convulsive movements and dies.

Now, there is noticeable during this period of the disease a most important symptom of which I have not said a word. I mean the characteristic red coloring of the skin which may be observed unevenly dispersed everywhere on the body where the skin is the most delicate and thin, particularly on the ears, under the belly, at the inside of the limbs, etc. These spots gradually take a violet or dark brownish color. In mild cases, however, they slowly disappear, while in violent and rapid ones the skin may become violet, or purple, or dark almost everywhere. This is always an indication of death

It happens sometimes that some of these colored patches form circumscribed tumors on the limbs, ears or tail. This is due to the septic material produced or gathered in these places, and which nature attempts to eliminate. In such instances the spots are very painful at first, but soon mortification sets in and causes sloughing of the diseased portions, and occasionally ot parts of the extremities affected.

These colored patches are not so plainly seen on dark skins.

CAUSES.—The true swine plague, as understood after modern veterinary scientific researches, is a specific disease due to a microscopic organism which, by certain means gains its way into the system. This organism is a minute germ and is termed by various scientists, "*bacteria*," "*micrococci*," etc. Therefore the usual atmospheric influences or the causes of ordinary diseases, such as bad feed, bad water, too rich food, foul quarters, etc., are not the direct causes of the malady, although they may harbor these germs and render the hogs more susceptible to their influence. Still the hogs should, no less, be kept in wholesome quarters and fed good aliments and pure water, for if those precautions are neglected, they may not only become in a fit condition to contract the contagious plague, but they may also become affected with some of the numerous other diseases to which swine are subject, and which are sometimes confounded with the so called hog cholera. It happens occasionally, for instance, that a certain condition brought on by highly nutritious food—a condition known as plethoric, congestive, etc., due to excess of rich blood caused by such food as corn in large quantity, is mistaken for swine plague. Indeed this ailment occurs sometimes in almost endemic form in some countries, and it has occurred in this State. But in such cases death may generally be avoided. The great majority may be cured by placing the patients in dry quarters, and giving them plenty of good clear water and one or two doses of one-half to one and a half ounces of sulphate of soda to each. In this form of affection there is no coloring of the skin as in hog cholera.

The *treatment* of swine plague is not very satisfactory. About the only things prescribed in America are: the immediate extermination of the diseased subjects, removal of healty ones to high, dry places where they may have access to plenty of pure water, the feeding of wholesome, cooling food; the burning and burying of all debris, bedding manure, etc., of dead hogs; the disinfection of pens, yards, fences, etc., with carbolic acid, chloride of lime and by fire; keeping the swine away from infested land or places which may become so by the washings from them, or where they may drink in infected streams; the ploughing of such grounds, after burning straw or something else all over them and covering them with lime; and finally the use of carbolic acid at a dose of five to ten drops, three times a day, in gruel or milk. All those measures are prescribed as preventives, and if strictly enforced, may do some good. But it does not pay to try to cure a choleric hog.

I am confident, however, that we are on the eve of a great revolution regarding the treatment and the prevention of this disease, and of others of about the same nature, such as splenic fever, blackleg, chicken cholera. etc., all of which are due to germs. For many years many great scientists among whom are the greatest chemist and microscopist of the world M. Louis Pasteur (the man who has discovered a cure for hydrophobia); the celebrated veterinary pathologists and experimentalists Toussaint and Arloing of France; the learned Drs. Koch of Germany and Klein of England; the eminent Professor Wehenkel of

Belgium and several other most able veterinarians and physicians of Europe, and a few of America, have been working to find the true nature of these terrible plagues, and to discover a preventive treatment, and it appears that Pasteur and his colleagues have at last succeeded in cultivating a benign virus for various diseases, and which by vaccination really has that effect.

Nothing seems more rational, since one attack by such a disease renders the subject proof against another from the same. Within the last year several local governments of Europe have tested the matter carefully and reported favorably, and to day the central society of veterinary science of France seems to believe in the effectiveness of the great discoveries. Their special investigating commissions seem no longer to doubt that a great precentage of the domestic animals may be prevented from contracting many of the contagious diseases which cause annual losses of millions and millions of dollars in almost every country of the world, particularly in America. Of course we cannot profit by those experiments right now, we want to be still further and better informed; but I hope they may afford us, ere long, the means to relieve our people, crying for help.

BLACK-LEG—BLACK QUARTER—SYMPTOMATIC ANTHRAX FEVER.

This is a disease peculiar to young cattle, just as some diseases in the human family are, for some reason not yet known, peculiar to children. Until recently we knew little about its nature, notwithstanding the efforts and constant experiments of learned scientists the world over. We are indebted particularly to Professors Arloing and Cornevin, of the Lyon Veterinary School, and to Mr. Thomas, Veterinarian at Dammartin, France, for our present knowledge of the affection. These great students have worked three years, independently of one another, and each of them has found the same cause and the same preventive treatment—the only difference is that the treatment is administered differently by the various operators.

The disease is due to a germ, *i. e.* "*bacteria*," which examined with the microscope, resembles somewhat the clapper of a bell. It differs from the germ of essential anthrax. These germs, once in the soil, are said to preserve themselves and to evolve in the system of the young subjects. The affection, although not transmissible from one animal to the other by actual contact, may, however, be communicated to men, cattle, sheep, cats and mice by the direct introduction into their system of poisonous matter taken from a diseased calf, or one that has just died.

The *symptoms* are well known to almost every stock owner in the country. It generally attacks the young subjects which are in the most thrifty condition. It seems that the germs have a surer chance in poisoning rich blood. At first the animals become listless, the ears are pendant, there is tenderness of the flanks, ribs and loins. It is not long before the pulse becomes rapid—from 75 to 120 per minute. There may be lameness or stiffness in one or more limbs, and a short time afterwards swellings appear about the head, or shoulder, or brisket, or back, or loins, or hips, or even at several of these places at the same time. These swellings occasionally appear without much, if any, stiffness or lameness. By pressure and friction on them, we may at a certain period cause a crepitating sound, attracting the ear about like the manipulation of light paper. This is due to the gas produced in the parts by the process of disorganization.

The appetite is lost, and rumination consequently suspended. There is usually constipation of the bowels and high colored urine. Depression finally appears and may augment gradually, or what is more common, it augments rapidly, and the animal dies in a comatose state sometimes after a period of convulsions. The swellings when cut into present a dark appearance, and a dark blood oozes out. Sometimes the first notice we have of the disease is a dead calf in the morning.

The *treatment* consists in changing the animals from one pasture to another (dryer, if possible), where, perhaps, the fatal germs no not exist. If this be the case no other is likely to take the disease there, for that year at least, unless it has already contracted it in the former place. A seton, consisting of a string or a tape-like strip of cotton cloth passed through the skin of the dewlap with a penknife or a large needle, and left there two or three weeks, is said to be beneficial as a preventive treatment, by the effects it produces in draining the blood. Carbolic acid at a dose of five to fifteen drops (according to the size and age), in a sufficient quantity of water to prevent its being caustic, is recommended, both as a preventive and curative treatment. When tumors or swellings appear they should be opened with a knife and the wound dressed with carbolic acid; one part to twenty of water, or about that proportion. Constipation may be combatted with injections of water into the bowels, or even by epsom salts at a dose of one-half to three-quarters of a pound or more, according to the size, etc.

When black-leg makes its appearance on a farm, and when some of the animals during or after its existence, are unthrifty, hide bound, stiff, with arched back; when they loose flesh, have irregular actions of the bowels, and irregular rumination, capricious appetite, etc., it may be admitted that they have the disease in a milder form. Therefore, they, too, should be especially attended to. Feed them with soft and not too nutritious food, and give sulphate of soda or epsom salts, at the dose already indicated for this medicine, and then gradually pass to a regimen of more nutritious food, and give carbonate of iron and gentian powder in doses of one-half to one dram each morning and night with nux-vomica powder at a dose of fifteen grains to one-half dram once a day.

But all these treatments generally fail if we administer them as curatives for well marked cases. Here again we live in hopes that the day is not far when we may have at our disposition a preventive vaccine. This form of treatment has already been tried in France and Belgium, and it seems from all reports that they have succeeded beyond their expectations.

PARASITIC BRONCHITIS.

This malady known as "hoose in calves or lambs," "verminous consumption of calves, colts, etc.," prevails in calves to an alarming extent in some localities of the State. It is due to the presence in the bronchial (or air) tubes of small, whitish, thread-like worms named *strongylus micrurus*, which are sometimes rolled into little bundles in a kind of yellowish or whitish mucous matter. These worms get into the system in the form of minute eggs and by certain means get into the lungs, where they develop themselves and cause trouble.

Symptoms.—Many calves may be found affected at the same time. They have a painful, hoarse and sometimes almost convulsive cough, with suffocation and slobbering at the mouth, and perhaps a mucous discharge at the nose. If we examine these discharges closely we will find some parasites. As the cattle swallow immediately after coughing, it is often necessary, in order to find these parasites, to thrust the hand into the throat quickly after a fit of coughing, and draw out some matter. Frequently, after coughing, the mouth is kept open and the tongue protruding as in an effort to vomit.

The patients become poor and weak, diarrhea sets in, and death happens in most cases about three weeks from the onset, and in the milder ones, in about two or three months. *Complete recovery* takes place only in a minority of cases.

Treatment.—The disease is not contagious, but the eggs deposited in pastures or other places may cause it to occur in calves, lambs, etc., grazing or fed in these localities. Indeed, this is the way it is propagated. Wet lands, pools, etc., seem to be the most favorable places for the habitat of those germs. They are, however, carried into pastures or other places at quite a distance by the animals themselves, by the intermediary of running streams, fodder, roots, grain grown on infested lands, etc. Therefore, as a preventive measure, we should avoid keeping or feeding healthy and diseased subjects together; avoid keeping healthy subjects in barns, yards, or on lands previously occupied by diseased ones (even if it was the year before); avoid pastures or any place, that water passing through an infected locality is likely to submerge, or where such water is likely to be drunk by the calves; and finally avoid over-crowding.

The diseased subjects should be removed from where they took the affection, and be placed on dry, high land if possible; and if impossible, place them in a good, well ventilated, dry stable. The feed should consist of something nutritious and a little laxative at the same time, such as linseed cake, or roots with oats, beans or corn, to which may be added, says Prof. Laws, equal parts of sulphate of iron, gentian and ginger, in the proportion of four ounces of the mixture to every ten calves three months of age. Increase or decrease the dose a little according to age and size.

In order to kill the worms, which are in the lungs, place the calves in a closed stall or building, and burn sulpher pinch by pinch on some paper on an iron shovel or dish, during about twenty minutes, or as long as the calves do not cough too violently. Stay in the stall in order to avoid any accident. This operation should be repeated every day, during, say one week, and then one day or more each week afterwards, for a period of one month, or even longer if necessary, so that the worms and their successive broods may all be killed. If this does not succeed, you may try Scheele's (medicinal) hydrocyanic acid, at a dose of from ten to twenty drops, in four to six drams of bi-carbonate of soda, twice daily. Pure hydrocyanic acid at that dose is poisonous. Give also bitter tonics, such as gentian.

One-half to two drams of turpentine every twelve hours in milk or gruel, is a treatment often followed with good results. It acts on the worms of the lungs, and also on another kind, frequently found in the bowels during parasitic-bronchitis.

DRY-MURRAIN.—IMPACTION OF THE THIRD STOMACH AND INFLAMATION OF THE FOURTH STOMACH (*Omastitis and Abomastitis*).

Before describing the often complicated troubles known as above, it is proper, I think, to explain in a measure the digestive apparatus of cattle, from the mouth to the small intestines at least, and its actions.

The principal organs composing that portion of the apparatus are the mouth, containing twenty-four molar teeth and eight incisives (at the front part of the lower jaw), the tongue, the salivary glands, the cheeks, the palate, the pharynx (or opening of the gullet), the gullet (or œsophagus), the first stomach (rumen or paunch), the second stomach (or reticulum), the third stomach (or omasum), and finally the fourth stomach (or abomasum, or true stomach).

Now, the principal objects of the tongue, cheeks, teeth, etc , are to take the elements, hold them in proper position and masticate them; the palate, which assists in that work, is the particular organ of taste; the salivary glands secrete the saliva (commonly called spittle), which serves to wet the food in the mouth and to impregnate it during mastication; the pharynx or back-mouth transmits it to the gullet; this organ by an uncontrolable undulatory movement of pressure—upward and downward—carries the great bulk of it to the first stomach, (arriving, and filling first the second stomach, which is the receptacle of food, and then overflowing into the cavity of the first). In the first stomach the food is thoroughly mixed with the saliva swallowed while eating and with other fluids drank, it becomes macerated, undergoes a certain fermentation, and it is returned to the mouth for the second mastication, which is more complete· This act is called rumination. After this is done, the food is returned to the second stomach, a small resevoir, which by contractions sends it methodically enough into the third. Thus it is really the second stomach which receives first all the alimentary substances. This becomes full and empties them, then, into both the first and third stomachs; i. e., it empties into the first the food to be masticated a second time, and sends directly to the third that which has been sufficiently ruminated, and that portion of the fluids which do not undergo this process. We will understand this readily in remembering that the second stomach is the center of the stomachal apparatus, and that it is situated below, directly under the opening of the gullet. The third stomach or paunch acts as a reservoir for the food to be ruminated, and for a great portion of the liquids.

The third stomach, also called manifolds, is a cavity divided into many partial compartments by strips of fleshy substance, which, regarding their disposition may be compared to the dividing walls of a poppy head; it officiates as usher, so to speak, of the food which it may find fit to admit to the last stomach for dissolution. The construction of its opening from the second stomach makes access difficult, to improperly masticated or insufficiently attenuated substances.

The third stomach acts, besides, as a compressor of the materials entering it, and thereby gradually forces the more juicy parts first into the fourth, while retaining for a time the coarser portions. Therefore, these are found dry and somewhat hard, even in health, but they become excessively so in a scarcity of drinking water, as well as under many other circumstances which we shall soon see.

Finally we come to the fourth or true stomach, (abomasum, rennet, etc). This is the proper stomach for true digestion. It secretes, like the stomach of other animals, a fluid named gastric juice, which has the property of dissolving the alimentary substances, and thus rendering their nutritious portion fit for absorbtion into the circulation, for the nourishment of the system, the repair of its daily losses, etc. Thus are outlined the habitual, or rather the principal actions of the main organs of digestion.

We understand then that cattle (and other ruminants, such as sheep, etc.,) nourish themselves by the following process: They eat a certain number of hours, they drink, and thus fill their paunch; then they stop eating, and the coarse food in store and mixed in that reservoir, is taken back to the mouth; there it is masticated again, made into slippery masses, sent back to the second stomach, and thence to the third; this one admits all that is properly attenuated, and gradually forces it by compression, to the fourth; and finally this true stomach dissolves it and allows it to pass into the small intestines. In these the food undergoes some more alterations by the action of the bile, pancreatic juice etc., the nutritious portions are absorbed, and the indigestible ones are thrown out by way of the intestinal canal. The water, minerals of the food, etc, after having served their purpose in the economy are also thrown out by various channels—the kidneys, the lungs, and the skin by perspiration.

During the process of digestion, the stomach is constantly in motion. It enters into slow contractions and begins its peristaltic movements—a kind of churning,—from the moment it is stimulated by the presence of aliments. When digestion is ended, the movements cease and the stomach comes to rest.

Cattle eat and ruminate from eight to ten hours in twenty four. During that time their salivary glands secrete an average of eighty pounds of saliva for the impregnation of dry food, and about thirty-two pounds in the interval of meals—making in all 112 pounds of saliva, secreted and swallowed for the purpose of impregnating, softening and macerating the alimentary substances. And yet this enormous amount is not sufficient; a large quantity of water is required, besides. Soft, watery food naturally requires much less saliva or water. Then, when food has passed from one stomach to the other until it has come to the last inclusively, it again comes in contact as we have seen, with another fluid, the gastric juice which, if we judge by some other animals, is probably secreted in a much larger quantity daily, than saliva.

Thus we may conceive what work is required to digest the aliments; what kinds of substances are likely to be most easily digested and what precautions should be taken to keep the digestive apparatus in good order.

Now, supposing that cattle having been kept on soft feed, roots or nice luxurious grass for a certain time, are abruptly changed and placed in a pasture containing withered or over-ripened hay, or bleached grass, or stubble, or a mixture of withered hay and green grass as in autumn, or corn-stalks, or smutty corn, or wheat, etc., what would occur? The digestive organs, having become accustomed to perform a certain amount of labor in a certain time with the assistance of a certain amount of fluids, secreted by the glands, and that drank by the animal, are suddenly shocked and momentarily paralysed, as it were, like a threshing machine that has been running regularly and smoothly by judicious feeding, when certain hard substances are suddenly thrust into the feeder.

The stomach not being used to such indigestible matters is suddenly embarrassed. It takes more fluids to dilute them; it requires more work and consequently a longer time to digest them; the food is therefore accumulated in the reservoirs, it requires a longer time for rumination, and the second mastication is not as perfect as it ought to be. Under these circumstances, the food passes too slowly from one stomach to another, at the third stomach it is compressed and has but little fluids to yield, the residue is packed hard between the thin strips of this cavity, where it dries excessively, and hence the irritation of that stomach,—an irritation which sometimes passes to inflammation, frequently extending to the fourth or true stomach, and even further in the bowels.

In other words, the digestive apparatus, (especially the stomach) is abruptly put to prolonged labor to which it is not accustomed, and this without receiving any re-inforcing constituents, and we have the conditions named "dry-murrain." Now let us reverse the conditions. Supposing that cattle are *suddenly* changed from the described dry food to soft, watery ones, or to the over-stimulating grass of spring, or to rich clover in great abundance, May we have the same results? Yes, but in this case we have more frequently the condition named tympany or "bloat" (of the paunch), due to extraordinary fermentation. This may be relieved, in the beginning, by puncture of the paunch in the left flank at equal distance between the point of the hip (or haunch), the last rib, and the lateral processes of the backbone.

The best instrument for this operation is what is called a *trocar* or *cannula*—a kind of round and pointed stylet, surrounded by a tube. This instrument may be thrust without fear into the side, and the tube may be tied and left in position for hours. If no trocar is at hand, make the opening with a knife, and insert a large quill into it. This should be resorted to immediately in all serious cases. In milder ones, it is generally sufficient to give muriate of ammonia in doses of one to three ounces in one pint to one quart of water, two or three times a day; or aromatic spirits of ammonia, three ounces in sufficient water, or in milk or oil. Oil of turpentine in two ounce doses is also very beneficial. It is usually necessary to clear the intestines with a dose of physic—say raw linseed oil, one quart; or epsom salts, one pound. Finally we may follow these treatments (where recovery begins) with one dram of carbonate of iron, one dram of powdered gentian, and fifteen to thirty grains of powdered nux-vomica twice daily, for a week or ten days.

Now I find myself treating of another disease than "dry-murrain." The two are so closely related regarding their causes, that I could hardly describe one without saying a few words in regard to the other, which also causes serious losses in this country. If we enumerate the above we find that the same conditions may cause many different troubles.

To give then, more fully, the principle causes of "dry murrain" and "bloat," I will say that besides what I have given, they are, for murrain: smutty corn, over-ripe but un cured grain, rye grasses, vetches, rusty or musty hay, and change from soft to hard water, or vice versa. For "bloat": white and red clover, green food covered with dew, crow-foots, lucern, vetches, beans, diseased or frosty potatoes, partially ripened peas, wheat, barley, etc., bulky, fibrous, dry, or in-nutritious substances, beans or cornstalks, etc. Under certain circumstances, any of these substances may cause either or both forms of indigestion, and an overfeed of any kind of good food might act likewise under certain circumstances.

SYMPTOMS OF "DRY-MURRAIN."—This digestive trouble manifests itself in mild cases by dry muzzle, nonchalence, stoppage or irregularity of rumination, moaning, and pains when punched with the fist on the right side over the short ribs. There is sometimes more or less diarrhea and then, generally, costiveness. The patient generally stands in an isolated spot, lays on its left side and keeps its head on the right flank. Later when the animal is forced to walk, it staggers and seems weak in the hind limbs; there is a kind of stupor or drowsiness, and frequently delirium and convulsions. In more acute cases the eyelids are half-closed when patient is down, there may be muscular tremors; the eyes glare when the patient is roused up, then it is almost constantly in motion to one side, or in a straight line, it pushes against fences, walls, etc., and bellows in a horrible manner, going to and fro irrespective of obstacles which it may meet. Very often the animals strain violently and pass a kind of bloody or mucous matter, indicating that inflamation, or at least irritation, has extended to the smaller intestines. Bloating occasionally takes place before death.

TREATMENT.—To prevent the occurrence of this indigestion and its consequent inflammation, it is simply necessary to avoid the conditions which may cause them—all of which we have already considered. Avoid, as far as possible, keeping your animals on any place where they are bound to partake more or less of indigestible food. But if this cannot be done, then get them accustomed to it gradually. Never change them suddenly from one regimen to another. Always watch them and make the alterations by degrees.

In mild cases, give from one pint to one quart of raw linseed oil, and follow with one to one and a half ounces of bi-carbonate of soda three times a day, with fifteen to thirty grains of powdered nux-vomica, morning and night.

In serious cases with nervous symptoms, administer ten to twenty drops of aconite tincture, or one-half to one dram of fluid extract of belladona every eight, six or four hours, according to the intensity of the symptoms. Injections of, say, one, two, four or more quarts of warm water may assist materially to start the peristaltic action of the bowels, and thus hasten the fæces.

Mustard poultices applied on the right side on the short ribs where pains are evinced by punching, are frequently followed with good results.

Feed soft substances, and during convalescence give iron and bitter tonics, as prescribed for animals in this condition, after "bloat."

Your humble servant,

(Signed). PAUL PAQUIN, V. S.,
Professor of Veterinary Science, Mo. Agricultural College, and State Veterinary Surgeon.

P. S. I have received from several able veterinarians of the State, several important letters concerning the diseases of live stock. For the benefit of the stock raisers of Missouri, I wish you would kindly insert the enclosed ones in your Agricultural Report.

P. P.

2627 OLIVE STREET, ST. LOUIS, MO., November, 24, 1885.

DR. PAQUIN, DEAR SIR: The City of St. Louis and surrounding country have a certain quota of disease to furnish. During the past year I have met with quite a number of cases of glanders, in most instances complicated with farcy, and with well developed symptoms. In one case, however, the symptoms simulated strangles or colt distemper very strongly. A diffuse, hard lump came between the jaws, and it looked very much, at first, as if an abscess was about to form. There was some yellowish discharge from the nose, no chancrous ulcers to be seen, pulse 60, temperature 103½°, poor appetite, and coat unthrifty. In a few days the swelling went down, leaving the submaxillary lymphatic glands hard and adherent to the bone. At the same time the nasal and turbinated bones became implicated, ulcers appeared, the breathing was very difficult, and several farcy sores broke out on the inside of the thigh and fore arm. In a few days his owner consented to his destruction, though he had hoped against hope from the day I had ordered isolation. Some Texas fever has also been developed in the neighborhood of the stock yards; due of course to cows being driven over ground contaminated by southern cattle. Nearly a year ago I had the good fortune to arrest an outbreak of ergotism in a herd of twenty-two Jerseys, all of which were affected. It was on a farm seven miles from St. Louis, and was caused by ergotized red-top grass, as I found by using a lens on the heads of the grass at my first visit. The weather was very cold and the water supply scanty; and thus, as Dr. Salmon points out, they were placed in an unfavorable condition to resist the constitutional effects of ergot. Examined each animal carefully between the digits and around the udder, as the owner feared "foot and mouth disease". All of the cases were in the first stage, their mouths were filled with reddish erosions, chiefly on the buccal pad and inside the cheeks. One or two were lame, but no coldness or line of demarcation yet formed; they were not so far gone. The old Scotch cattle-man in charge poohpoohed the idea of "foot and mouth," he had had too much experience with that trouble at home. Gave a laxative, and placed on belladonna. Could not get timothy, so used the red-top still, but gave bean mush and a plentiful supply of water. The cases fully recovered in about two months. Have also seventy-seven sheep under treatment, at present, for scab. Many hogs have died in this section, but have not investigated cause so far, as I have had no calls to treat swine in my professional capacity. Chicken-cholera has played sad havoc with our fine poultry; we wait for the Bureau of Animal Industry to furnish us with attenuated virus. Black-quarter has prevailed on various farms, many fine yearlings have fallen victims; setoning the dew-lap has generally prevented its progress in a herd. From what I have said you can see that much disease is prevailing which might just as well never be allowed to develop, not only from pecuniary, but also from humane motives. Wishing you every success in your efforts to place the animals of this State on a good sanitary basis,

Believe me,
Yours sincerely,
(Signed). H. F. JAMES, V. S.

Translation of a letter from Dr Rouif, veterinarian of St. Louis, to Dr. Paquin, concerning *milk-fever* in cows, and its very successful treatment in France:

Dear Professor:—In reply to your letter of inquiry, my opinion concerning *milk-fever* might have been eventual if you had asked me that question a few years ago. To communicate to you fully what I think of it to-day, allow me to enlarge somewhat on this malady, *i. e.*, to explain to you how it has been considered for a century and a half, and what modern science recognizes it to be to-day, for profound students have just classsified it as a disease easily cured.

[Here the Doctor goes on describing the history of the disease, but for want of space we regret to say we cannot reproduce it, and we are forced to leave out several other items of great importance to the profession, but not indispensable to the stock raiser].

Symptoms.—This disease, special to the cow, so to speak, although it has occurred in bitches and she-goats, makes its appearance a few hours after parturition, but often a couple of days after.

If it comes immediately after parturition, the premonitory symptoms are well marked, there are rigors of short duration, a quarter of an hour perhaps, sometimes intermittent, without perspiration; the skin becomes cold, with a certain rigidity of the body; we notice spasmodic contractions of the limbs, which constitute the first signs of the paralytic condition; rumination ceases; the face is anxious; the animal frequently changes place, agitates its tail, endeavors even to strike with its horns; it often stretches as if to pass urine; and in a few hours it lays down, and generally on the right side. It is generally in this condition that the veterinarian finds his patient, and here begins our symptoms of the disease.

If I give you the symptoms which are forerunners of this affection, it is in order to enlighten the proprietors and stock raisers who might recognize its gravity in time, and call a veterinarian if possible, or otherwise act according to their knowledge.

Here are some symptoms which can never escape the eyes of the practitioner, nor even those of the intelligent agriculturalist. The beast is lying down on the right side, as I have just said, it turns its head to the left as though to look at its belly, which, in fact, is painful; if we try to straighten the head, it falls back again as though drawn by a spring; there is prostration, torpidity, drowsiness; the animal allows itself to be handled like a dead mass; we may draw it out of the stable and even kill it without any movements on its part. There is a general annihilation of the strength, the eyes are always dull, sunken and with dilated pupil; we may touch the globe of the eye without provoking a movement on the part of the patient; the ears are pendant, cold, as are also the extremeties; the pulse is small and rapid—80 to 90 per minute; temperature 103 deg., 104 deg., or 105 deg. F.; there is grinding of the teeth; the mouth is full of saliva, which flows in stringy froth; the mucous membranes are generally pale, with the exception of that of the genital organs, which is more or less swollen, red and more or less sensitive; the vagina is dry; ordinarily there is no flow of urine; there is obstinate constipation; the excrements are dark and coated, and sometimes about the end of the disease there is diarrhœa; it occurs too, when the disease is prolonged, that the secretion of milk stops; the beating of the heart is often tumultuous; the circulation is accelerated, while the respiration remains calm; the hind extremity becomes paralyzed first; the head is senseless to the pricking of a pin; and we also observe convulsions in vigorous animals.

TREATMENT.—Divers and much opposed treatments have been recommended for this disease, but all have been without success until very recently.

We have to-day in the "*Recueil de Medecine Veterinaire*," published at the Alfort veterinary school, under the direction of Drs. H. Bouley, Chauveau, Barrier, etc., etc., a treatment which is most efficacious. Its success has been confirmed by a large number of practitioners. It has been put in practice, first by Mr. Hartenstein, and then by Mr. Mathe, veterinarians.

By the way, this treatment and many other important ones, may be found in a pamphlet publised by Mr. Hartenstein, under the title "*Hydrotherapie appliquee a la medecine des animaux*" (or "water treatment in animal diseases").

The treatment referred to is a mixed one, the principle agent being affusions of cold water on the head and back, with bleeding often repeated according to symptoms, and finally drastic purgatives.

Mr. Hartenstein's treatment is:

Bleeding, five pounds; affusion of cold water several hours; and a physic composed of aloes 40 grams (*i. e.*, one ounce and two drams).

[NOTE.—I may say that this treatment has been frequently applied, with success, without bleeding, though in cases in vigorous animals with high and hard pulse it is certainly beneficial. Mr. Hartenstein's treatment is now generalized in France, and he has received innumerable letters from veterinarians, attesting to its efficacy. As a physic, one pound or more of epsom salt may be used instead of aloes—P. P.]

[After giving the names of the men who succeeded with the treatment, etc., Dr. Rouif continues]: For my part, dear professor, I declare that so often as I have had occasion to treat milk-fever, I have employed Mr. Hartenstein's method, which has always given me full satisfaction, so much so that my advice is that it should be published in America, in order to introduce it generally in this great stock raising country, and thus contribute to protect millions of dollars invested in the bovine species. The proprietors themselves may apply the treatment without the assistance of any veterinarian, provided they recognize thedisease.

Accept, dear sir, the assurance of my consideration.

(Signed). DR. A. ROUIF, M. V.,
1122 Chestnut Street,
St. Louis, Missouri.

DR. PAUL PAQUIN, V. S., STATE VETERINARIAN, *Columbia, Mo.:*

DEAR SIR: Your communication asking me for accounts and statistics of contagious and other serious diseases of animals in my section of the country, was received a few days ago, and in reply I will briefly describe a few cases taken from my note book;—

[Here the writer, Dr. T. E. White, veterinary surgeon of Sedalia, Mo., goes on with a fine description of a few cases of glanders which came under his notice. But his communication having come to us a little late, and it being lengthy, we regret to say we cannot reproduce it in full. Further, the doctor describes several cases of "omastitis," erroneously called, he says, "dry-murrain," He speaks of an outbreak of the malady (due to a change of diet) among 205 head of three and four year old steers, owned by Mr. M. H. Garton, Deerfield, Vernon county, Mo., and which had been shipped from Colorado to Kansas City, and thence to Deerfield a short while before. Eleven head of this lot, and fifty head on neighboring farms, are reported to have died with symptoms of omastitis. We are sorry to be forced to exclude, also on account of want of space, the details of this excellent article. A description of glanders and murrain may be found in this report. We reproduce in full Dr. White's statements on chicken disease and hydrophobia.]

HYDROPHOBIA.

September 1st, 1885, a Mr. C—— came to my office, to consult me in regard to a calf that had been ailing for a few days.

History:—It would stop while sucking and bawl in great distress and eventually would give up in dispair. It would try to eat everything, and was very fond of carpet rags, etc. It kept up this spasmodic bawling day and night. I told him probably it had a needle in its throat, and ordered a cathartic, as it was bound up. It died on the 4th. September 6th, Mr. C—— came again, and informed me that one of his horses had been sick all day with a slight colic; that he had given three doses of medicine which had given no relief. He did not want me to make a visit; he only wanted a *quick purgative*, as his bowels had not acted for two days. He stated that the horse was very hard to drench, as his jaws were partially locked; he would strike viciously and try to bite him. He died on the 8th. On the 10th, he called again to see me, and informed me that two of his pigs had died, one on that day and one the day before. He then gave me this history: On August 19th, just after dark, a strange dog had a fight with his bitch, and bit her puppy, one pup being under the house and so escaped, for it is living up to this writing.

Mr. C——'s bitch bit two of his neighbor's cats, one of which she killed outright, and the other of which died in a fit. She also bit their two pigs, which died in fits, as also did the puppy. She grabbed one of these pigs and jumped the fence with it in her mouth. Mr. C—— hallooed at her; she dropped the pig but kept on running and has never been seen since.

Another.—I was summoned in all haste to visit the mule-pens to see a *mad* horse. On my arrival they had just managed to lariat him from amongst the rest of the horses and mules, which he had been running, biting and kicking very viciously for the last hour. We tied him to a post, but he kept constantly snapping his teeth, and his eyes were in constant motion, and he watched me so closely that I decided that I was just as close to him as was safe, and so I kept at a safe distance. I then had him turned in a pen by himself where I could watch him. He would be quiet for a while (except that wild staring look), and then with mouth open and ears laid back, would make a rush at the walls at some phantom. That night he went down paralyzed in both hind legs, and was unable to rise any more, but continued to fight the air all the while with his fore feet. He was found dead the next morning by the stable men.

A post mortem examination was made only on the internal viscera. The stomach contained about a gallon of well masticated food, and all the viscera were perfectly normal except the heart, which was very soft and flabby, and showed a typical case of chronic, fatty degeneration.

Another.—Sept. 8th, I was requested to visit ex-sheriff Connors' family mare; she was standing in a lot with the halter on; her eye (one being blind) was in constant motion, and very brilliant. Whenever I approached her, she would become very much excited, and paw the air with one foot very viciously, and throw her head up and down very fast; he offered her some water, but she would not drink; he then got a sheaf of oats; she grabbed a mouth full but would not eat it, only held it in her mouth; the oats brought the chickens around her, which appeared to put her in a perfect frenzy; she would make a lunge at them and try to tramp them with her feet; she did kill and cripple three; he then led her into the stable, this so excited her that she reared up against the wall and then in the manger, which threw her down; the sheriff let go the lead-rope and scaled the wall; I ran out the door and the mare after me. Once out in the lot, she quieted down to the condition she was in on my arrival. I diagnosed it hydrophobia, and gave no treatment.

In conversation with his son (our present county recorder), I learned that she had been bitten on the lip by a strange dog about two months before. Our county fair going on at the time, and being very busy, I did not make an autopsy.

CHICKEN DISEASE.

The fancy Plymouth Rock breeder, Capt. Ed. W. Stevens, has lost something over three hundred of his choicest birds, supposed by every one to be from chicken cholera. Being a subscriber to most all the poultry journals, he of course tried all the remedies that he had read of, but without effecting a cure. Being in conversation with him one day, he gave me the following history:

"I first noticed my chickens drooping about the middle of July; they were not very loose in the bowels, and would droop round a few days before refusing food, and then die apparently without a struggle. I could pick up several every morning under their perch, where they had dropped off dead. And what seemed so strange to me, none of my neighbors have lost any, notwithstanding they mingled with mine daily. I fed my fowls very high, as I intended to make show birds out of a great many of them, Their food consisted of corn meal, ground oats, barley and wheat. I also stimulated their appetites with ground red pepper, and I was very particular about their having fresh water every day, and plenty of lime in their houses, besides washing their roosts frequently with dilute, crude carbolic acid, and having droppings removed twice a week. I have plenty of room or range, nearly five acres. They continued to die up to the second or third big frost. I now have seventy left, and the hens are all laying finely, and all appear to be perfectly healthy."

AUTOPSY.—By request, Mr. S. brought two pullets to my office for post mortem examination. Their combs and wattles did not betray any grave sickness, but their walk was tottering and their heads hung down; the skin was of the natural pink color; and no signs of diarrhea. I opened them through the breast, and found all the intestines perfectly normal in their whole length. One of the stomachs contained a single grain of corn, and both had some pieces of grass and some gravel. But the livers were enormously enlarged (hypertrophed) and infiltrated with fat; the livers weighed respectively, three and three and one-fourth ounces. Thinking this might be mistaken for some contagious disease, I thought it might not be out of place to give the

PATHOLOGY OF FATTY INFILTRATION.

Fatty infiltration is caused by high feeding, more particularly by food containing an excess of the hydrocarbons, such as the food on which these chickens were fed. It occurs as a physiological process, and is apt to occur in all animals, as well as birds, quickly prepared and made fat for sale. It also frequently occurs in very highly fed horses employed for slow work, and often causes death by the liver enlarging to such an extent as to burst its capsule. Why the liver should suffer from the accumulation of fat is explained by the fact, that when animals are fed on hydro-carbonaceous food, an excess of fat in the blood is the consequence, such fat being, before it is finally disposed of, deposited in the hepatic cells, more particularly in those cells in close contact with the capillaries of the vena-porta, at the circumference of these hepatic lobules. This temporary infiltration occurs after every meal, and the fat passes from the cells at the circumference to those situated more within the liver, then into the blood vessels, and is finally disposed of, either by being deposited in other tissues, or destroyed in the maintenance of the animal heat. By bearing these facts in mind, we can the more readily understand that when an animal is constantly fed on such diet, the accumulation may be too great to be disposed of, or consumed so long as the animal continues to be so fed and treated, interfering to some extent with the secretory powers of the organ, and rendering it unfit for ordinary work.

Such was the condition of the heart and liver I expressed to you. It is well known that a practice prevails in many parts of our State of fattening animals rapidly prior to showing them for sale, by giving them an immoderate quantity of highly carbonaceous food.

To the eye, such animals present all the signs of good health. They are, however, totally unfit for work, as the liver and other internal organs are loaded with fat.

Respectfully submitted,
(Signed), T. E. WHITE, D. V. S.
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COMMON ROADS.*

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In every nation and in every age, the means provided for the interchange of commodities have been to some extent exponential of the civilization of that country and time. Certain it is that these means—roads and vehicles—have, in the forward march of progress, kept front and step with those advances in science, in the arts and in government which go to make up the grand legion of man's achievements.

The origin of roads is to be found in the necessities arising among men in any the least degree civilized. For when our race, emerging from mere savagery, began to form social relations, and when each man began to follow a particular pursuit, depending upon one or a few products for the gratification of his many wants, there arose a necessity of constant exchange. And to facilitate—nay to make possible—this exchange, roads of some description were required. So the narrow pathway came to be replaced by a rude highway, suited to beasts of burden, or perhaps to some rude vehicle.

As primitive societies expanded into nations, as the products of different communities came to be exchanged, and as invention suppled superior vehicles, roads were correspondingly studied, extended and improved.

At the present time, when the division of labor is practically complete; when whole communities depend upon remote manufacturing centres for artices of convenience, luxury and use; when such centres in turn depend upon remote agricultural districts for the necessaries of life; when the innumerable productions of nature and of human skill are brought and sent from and to every part of the world, the increased demands of commerce have led to the study of road-making as a science, and the establishment of road construction and maintenance as one of the professions. A science and a profession not to be lightly held; unrestricted trade is among the first motives for, and the highest privileges of organized society, while roads are the means by which this privilege is made of effect, and extended to every part of the political body. So to-day the river is bridged, the mountain pierced, the valley spanned, forest and plain traversed, until city is joined to city by iron bands; the turnpike winds from town to town; while from city, town and village common roads radiate and ramify indefinitely.

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Truly a grand arterial system through which the mighty heart of human wants and needs sends pulsing the life blood of the political body,—trade,—vitalizing every member.

The common or dirt road has long since been improved upon; the railroad, the asphalt, broken stone, gravel and other roads being superior to it as respects rapidity of transportation and draught of loads. But the enormous first cost of all these as compared with that of dirt roads will preclude their construction except where the prospective traffic over the road will justify a large outlay. So while railroads and turnpikes are required between our centres of population, of wealth, and of manufactures, for securing most economically and in highest degree the benefits of commerce to such centers, common roads will always be necessary for diffusing these benefits through every community and district of the land.

The United States leads the world in the extent and excellence of its railroads, and in—the pitiable condition of its common roads; the most that is ever done for these being the allotment of a space for them to pass over, and the application of annual repairs, generally insufficient in quantity and often injudiciously applied. The reason for this neglect seems to be that because dirt roads are necessarily inferior to asphalt, broken stone, gravel and other artificially covered roads, it is considered a waste of effort and money to devote any particular attention to them. The reasoning is unsatisfacfory, on the contrary, since, as we have just seen, dirt roads are a necessity, every effort should be made to offset this inferiority of road-surface by the closest attention to grades, drainage and other conditions tending to improve the general condition of these roads.

It is believed that the advantages secured to any community by good roads will amply repay the expense incurred in constructing and maintaining them. Among these advantages are: access to market at all times, a saving in horse flesh, the reduction in the number of wrecked vehicles, the multiplied capacity for heavy transportation, the convenience of quick and safe journeys, the increased value of real estate, the stimulus created for improving homes, and the ambition aroused for a better state of things in general.

The principles governing the construction and maintenance of roads are few and simple, and will be briefly considered.

ESSENTIAL QUALITIES OF GOOD ROADS.

A perfect road would be one satisfying the following conditions:

First—Its surface should be smooth, hard and inelastic.

Second—It should be straight.

Third—It should be level.

All roads will be better or worse, according as they satisfy these conditions more or less completely.

These conditions will often conflict in practice, particularly the second and third. The direct route may lead over elevations and depressions where proper grades cannot be established at any reasonable outlay, while a level course would involve a lengthening of the road and invasions of private property not to be thought of. In such cases there is to be sought that golden mean which, while satisfying none of the foregoing conditions rigorously, yet satisfies all most nearly; and he is the best road maker who best harmonizes these conflicting essentials of a perfect road.

The advantages resulting from proper condition of road surface, straightness and levelness will be considered in order.

Proper Condition of Road Surface—On a level road the principal resistance encountered in drawing a load is friction: the force which opposes the sliding of one body along another, and caused by the interlocking of the roughnesses of the surfaces in contact.

No surface can be made perfectly smooth; if such were possible the smallest conceivable force would move horizontally over such a surface the greatest conceivable weight.

The best that can be done is to reduce the roughness of the road surface to the smallest practicable limit, and this is the end in view in substituting for the natural surface of the road some artificial covering such as asphalt, plank, gravel or broken stone compacted with earth. The two last coverings are superior to the natural surface principally because they drain better and do not get muddy.

The friction is greatly increased when the road surface is covered with mud, or in fact, any loose material into which the wheels of vehicles can sink and thus give a larger contact. Hence the importance of securing a hard road surface.

Thorough drainage, alone, will go far toward making dirt roads equal to any, by at once carrying all water from the road-surface keeping it smooth and hard.

Besides lessening the draught of loads, smoothness diminishes the wear and tear both of vehicles and road.

If the road bed be in the least degree elastic so as to yield beneath the wheels of passing vehicles, this yielding will present a small hill before the wheel, up which the load must be raised with all the loss of power incurred in ascending slopes generally. "If the depression were one inch and the wheel four feet in diameter, a slope of one [inch vertical] in seven [horizontal] would be formed; and one-seventh of the entire weight would need to be raised one inch. An elastic bottom for a road, such as a boggy substratum, would for this reason cause great loss of draught."—*Gillespie.*

Hence, the necessity of thoroughly draining the sub-surface as well as the surface of the road.

The power necessary to overcome the resistance of friction is called the *tractive force* for level roads, and is generally expressed as a fraction of the load moved; thus if the *tractive force* for a certain road be one-fortieth, a force of 100 pounds will draw a load of 4,000 pounds over a level stretch of the road in question.

The experiments of M. Morin on the draft required on various road surfaces, put this force at one-fortieth for carts on dirt roads in first-class condition.

Unfortunately, the changes in the tractive force for dirt roads corresponding to changes in the condition of the road have not been determined by experiment; but they may be inferred from the variations for broken stone roads as determined experimentally by M. Morin. These are given in the following table:

Condition of road.	Tractive force (for carts).
Very dry and smooth..	$\frac{1}{75}$
Moist or dusty..	$\frac{1}{55}$
With ruts and mud....................................	$\frac{1}{33}$
With deep ruts and thick mud............................	$\frac{1}{10}$

The above table shows how important it is to keep any road in good condition, and how greatly the draft is increased by mud or dust on the surface; a horse being able to draw four times as much on a broken stone road in good condition as on the same road covered with deep ruts and thick mud. Assuming that the tractive force on dirt roads increases in the same proportion as on broken stone roads, the tractive force on a dirt road in poor condition would be one tenth of the load moved, taking one fortieth as the tractive force for the road in good condition.

The value in dollars and cents of any improvement of the surface of the road can be easily calculated, as an example will show:

In this and all subsequent examples it will be assumed that a horse can exert a tractive power of 100 pounds when travelling two and one-half miles per hour and working ten hours a day—the values given by Trantwine—and that the hire of a horse is fifty cents per day.

Suppose the amount of freight over a road twenty five miles long is 2,000 tons per year, and that the tractive force on the road is one-sixteenth. A horse exerting a tractive power of 100 pounds, or 0.05 tons, can draw 0.80 tons over this road per day; or, he can draw over the road the whole freight of 20,000 tons in 25,000 days, which at the rate of $0.50 per day will make the annual cost of freightage $12.500. Now, suppose that by thorough drainage, or otherwise, the tractive force is reduced to one fortieth. A horse can now draw two tons over the road per day, and transport the total freight in 10,000 days at a total cost of $5,000.

A saving of $7,500 annually, resulting from the improved condition of the road surface alone, and this without taking into account the diminished breakage and wear of wagons, etc.

STRAIGHTNESS.—Every bending of a road increases its length, and every increase of length involves a three-fold additional expenditure: in the original cost of construction, in the cost of repairs, and in the time and labor spent in travelling over it. As has been stated, it will seldom be possible to find a route for a road which will be both straight and level. The latter condition is by far the more important, and when the two conflict the former should in nearly every instance be ignored. For this reason roads should wind around hills instead of going over them, the rule being that to escape a hill, the length of the road may be increased by twenty times the height of the hill.

Section line roads, principally objectionable for reasons that will appear further on, are generally unnecessarily long. For if the general direction of a road be any other than due east and west or north and south, its length will be greatly increased by zig zagging it to the east or west and then to the north or south, as must be done if the road be made to follow the section lines.

Thus a farmer living five miles south and west of a town will have to travel ten miles, as the roads usually run, to get to market; while by a direct road he would have to go but a trifle over seven miles, a saving in distance of three miles or thirty per cent. practically. Suppose that the farmer will haul over this road 100 tons annually. Assuming the strength and daily cost of a horse as before, and a tractixe force of one-twentieth for the road, a horse will haul one ton over the ten miles, in four hours, at a cost of $0.20. At this rate it will cost $20 to haul the 100 tons ten miles, or $14 to haul it over seven miles, giving an annual saving of $6 by the direct road as compared with the section-line road. Further, this is the saving in cost of transportation alone, ignoring the amount the farmer must pay for the construction and repair of the extra three miles of road, and the saving in time, since the direct road virtually moves the farm three miles nearer to town. The above amount ($6) may be taken as a rough estimate of what every farmer pays annually for the one item of extra distance travelled on account of section line roads.

Levelness.—It has been stated that on a level road the principal resistance to be overcome is that of friction. In going up a slope or grade this friction must still be overcome and a part of the load lifted as well. And in taking a load to the top of a hill there must be performed, independently of friction, an amount of work equal to raising the load vertically the height of the hill, and this whether the slope be steep or gentle.

Hence, it will often be advisable to go around hills even when they can be ascended by easy grades; and when the general direction of a road is up grade it is of the utmost importance to avoid descents along its line. Gentle grades are always desirable because they give a greater *mechanical advantage*, enabling a horse to take up a hill what he could not move vertically, as the lever enables a man to lift what he could not otherwise stir.

A grade is designated by a faction having unity for its numerator and for its denominator the horizontal distance corresponding to a rise of one foot. For instance, a grade of one twentieth denotes a rise of one foot in twenty. This fraction also expresses the ratio of the draught on a grade to the load drawn, friction being neglected.

The total draught on a grade is expressed by the sum of the fractions, expressing the grade and the tractive force on a level stretch of the same road. For instance, in ascending a grade of one-twentieth a horse has to exert a lifting force equal to one-twentieth of the load drawn in addition to overcoming the usual friction; and if the tractive force for the road, that is the force necessary to overcome this friction, be one-thirtieth, the total draught on the grade will be one-twentieth plus one thirtieth, or one-twelfth of the load drawn.

But these results, which are purely theoretical, fail in practice, for the reason that a horse cannot pull at so great an advantage on an incline, on account of the position of his body, not being able like a man to throw forward the centre of gravity at will. According to one authority. "though a horse on a level is as strong as five men, yet on a steep hill he is less strong than three."

Experiments show that a horse can draw about four-fifths as much on a grade of one-fiftieth as on a level; about two-thirds as much on a grade of one thirtieth; one-half as much, on a grade of one-twenty-fourth; two fifths as much on a grade of one-twentieth; and only one-fourth as much on a grade of one-tenth as on a level. These values will vary to some extent with the nature and condition of the road. And since the load over the whole road must not, as a rule, exceed what the horse can draw over the steepest portion, one steep grade upon a road will operate to diminish the loads that could be drawn with ease over the rest of the road. Hence the advisability of bending a road, although its length be considerable augmented in consequence, if by so doing we can avoid steep grades.

The practice of running roads along section lines, compelling them to follow a straight course regardless of the hills and hollows encountered, is thus seen to be contrary to the first principles of road-making. Such roads are not objectionable, merely because, preventing the avoidance of elevations and depressions, these must often be crossed of necessity; but given the privilege of zig zagging a road, and ascents and descents can be accomplished by grades as gentle as may be desired.

A perfectly level route for a road will seldom be attainable, however desirable it may be. Hills must be ascended and descended; and since directness of route and economy of construction are to be kept constantly in view, it becomes of importance to inquire as to the grades allowable on good roads.

For descending vehicles, grades should not exceed the *angle of repose*, or the angle at which the friction just balances, the component of gravity tending to pull the vehicle down the grade. On such a grade, a vehicle set in motion will descend without any increase of velveity, and will not require to be held back. Hence, if the tractive force for a road be one thirtieth, the steepest allowable grade, viewed as a descent, would be one-thirtieth for the road in question. For ascending loads the grade should be such as the horse can, by reasonable extra exertion, ascend with the load that he can easily and constantly draw over a level road. This grade cannot be definitely determined as it depends on the amount of extra exertion a horse can put forth.

The *angle of repose* is generally adopted for the maximum grade allowable on good roads, and this angle should not exceed one-thirtieth on a first class road. If for any reason a grade greater than this angle should be adopted, special attention should be paid to improving the road surface at that point, offsetting the increased steepness of grade by a diminished frictional resistance. On a long ascent, the grade should be made steeper at the bottom and gentler at the top, that the horse may accomplish the steepest portion while fresh. When the direct route up a hill would give an excessive grade, the road may be zig-zagged sufficiently to secure the desired gentleness of slope. In such cases the grade should be made easier at the curves, on account of the heavier draught at these places.

To illustrate the effects of grades take the example given on page 238; namely, a road twenty-five miles long, an annual freightage of 20,000 tons and a tractive force of one-fortieth. It has been shown that a horse can transport this freight over the twenty-five miles in 10,000 days, if the road be level, at a cost of $5,000.

Now, suppose a grade or grades of one-tenth upon the road. In this case the horse can take only one-fourth his load on level ground, and will haul the freight in 40,000 days, at a cost of $20,000.

Now, suppose that all the grades are reduced to one-thirtieth. The horse can now draw over the road two-thirds of his load for a level, and will transport the freight in 15,000 days, at a cost of $7,500, giving an annual balance of $12,500 in favor of easy grades.

Of all the requisites of good roads, this one of easy grades is by far the most important. If roads are to follow the section lines in the future, the hills encountered must be attacked with a vim before even tolerable roads will be attainable. Year by year, let these hills be cut at the summit and filled in at the bottom, thus diminishing their steepness in a doube ratio, and it is safe to predict that in a few years the saving in haulage will well repay the expense incurred.

The following table made up from one prepared by John Law, C. E., may be of interest in this connection. It gives the length of level road equivalent to one mile of the inclined road of each gradient; that is, the length which would require the same mechanical force to be expended in drawing a wagon over it as would be necessary to draw it over one mile of the inclined road. The table is computed for a stage wagon with a load of six tons, and moving three miles per hour:

Grade.	Equivalent length of level road.	Grade.	Equivalent length of level road.
$\frac{1}{60}$	1.850	$\frac{1}{23}$	3.213
$\frac{1}{55}$	1.926	$\frac{1}{20}$	3.538
$\frac{1}{50}$	2.019	$\frac{1}{17}$	3.991
$\frac{1}{45}$	2.133	$\frac{1}{15}$	4.388
$\frac{1}{40}$	2.274	$\frac{1}{13}$	4.906
$\frac{1}{35}$	2.456	$\frac{1}{10}$	6 067
$\frac{1}{30}$	2.699	$\frac{1}{9}$	6.623
$\frac{1}{27}$	2.888	$\frac{1}{8}$	7.315
$\frac{1}{25}$	3.038	$\frac{1}{7}$	8.199

LOCATION OF ROADS.

In laying out upon the ground the route for a proposed road, the locator should see that the foregoing conditions are complied with as nearly as the surface of the country and considerations to be hereafter mentioned will permit. That is, he will seek to join the points of arrival and departure by the shortest or most direct route; make no unnecessary ascents or descents; and avoid places where, from the nature of the material passed over, the road surface would be deficient in hardness, smoothness or non elasticity.

He should, as a rule, follow the boundaries of private property whenever a good road can be constructed at a reasonable outlay along such boundaries.

He should keep economy of construction constantly in view. To this end, he will avoid deep excavations and high embankments; and where cuts and fills must be made, he should so choose the route that the material taken from the former may supply that required by the latter. He will avoid rock cuttings, whenever possible to do so; also swamps, which would necessitate extra precautions as to drainage, and perhaps, the construction of a foundation for the road. Further, the route should be so chosen that few mechanical structures will be required; such as bridges, culverts, etc.

These general rules will often conflict; and in deciding which to observe and which to ignore, the locator will be guided largely by the circumstances of each particular case. A deviation from the direct route will often be advisable for the following considerations:

In order to cross a ridge at a depression, thus avoiding deep and expensive cuttings, or steep grades; to locate the road well up on the side of a hill, in order to avoid bridging or filling secondary water courses; to get around swampy places instead of crossing them; to conform to the windings of a stream rather than by crossing and recrossing it necessitate the construction of numerous bridges.

In order more completely to satisfy the foregoing conditions, the locator should familiarize himself with the country through which the road is to run, by travelling over it *in both directions*. In both directions, because slopes will often appear in very different lights according as he is ascending or descending them. He should pay particularly attention to the streams, as these are invaluable aids in pointing out the best routes between and over ranges of hills. He should inquire as to where low points exist in the ridges to be crossed by the road; what places are free from, and what filled with snow in winter; what places are most exposed to the wind and sunlight, as these aid in drying the road; and finally, the greatest height and extent ever observed of any stream along the route, so that due precautions may be taken against any damage to road or bridges from a rise of water.

A great deal of information as to the general character of a country may be obtained from a map showing the streams alone. These will indicate the positions of the valleys and intervening ridges, as they always follow the lowest lines of the valleys.

A very crooked stream, with curving bends, generally indicates a wide, smooth and nearly level valley; while streams made up of straight stretches, with abrupt changes of direction, and with branches running in at large angles, indicate a rocky country with narrow valleys and steep hills. If the streams appear to radiate from, or converge to, a certain point on the map; that point will be the highest of the district mapped in the first case, and the lowest in the second. If two streams rise near together and flow in opposite directions, the lowest point of the high land between them will be at their sources. Two parallel streams flowing in the same directions indicate that the dividing ridge has the same general direction and inclination. Two streams flowing for a time in parallel directions and then diverging, indicate that the lowest point of the dividing ridge is at their place of divergence.

In his examination of the country, the locator will note all *ruling points*, or points through which it would be particularly advantageous for the road to pass, as a gap in a range of hills, a valley leading up to the summit of a ridge by an easy grade, and the points on streams suitable for the construction of fords or bridges; and will join these points by stretches of road located in conformity with the suggestions previously made.

CONSTRUCTION OF ROADS.

While it will often be advisable to treat freely with gravel, stretches of road that are clayey; and with clay, places where the road-bed is loose and sandy; yet, as a rule, in the construction of dirt roads the material passed over must be accepted as found. Hence the road maker must strive to make the most possible out of the materials met with; and this end will be accomplished principally by thorough drainage.

Water is the great enemy of good roads; in large quantities it washes it into ruts and gullies; in smaller quantities it softens the roads-urface so that it works up into mud, the effect of which upon draught has been considered; and in the winter it freezes and throws up the earth that has been soaked with it, thus roughening the road surface. Hence the great importance of quickly and thoroughly ridding the road-surface of water.

To this end the road should be highest along the center line, sloping thence to the sides. Engineers are not entirely agreed as to the best transvese form for a road. Some advocate a continuouosly curved outline, but the weight of evidence is in favor of two inclined planes connected at the middle by a narrow, curved surface. The former, or old form, is objectionable because being steep at the sides and flat in the middle, water will stand on that part of the road, and vehicles, to avoid a side strain and the danger of upsetting, will generally follow the middle of the road, causing excessive wear of that portion.

The side slopes of a road should have an inclination of perhaps one-thirtieth, although the grade necessary in any case will depend largely upon the nature of the material composing the road-bed.

In order more fully to drain the road surface, some advocate a slight longitudinal grade, say of 1 in 125, but it is doubtful if it would pay to construct such grades on a level road.

Upon long grades, and wherever an ascending and desending grade meet, transverse or diagonal drains should be constructed for conducting away the water flowing down the road longitudinally.

These drains, called catch-waters, should be wide, shallow and roughly paved. On a grade a catch-water discharging on one side, should cross the road angling down hill; if discharging on both sides it should be in the form of a " V " with the point up grade.

They should be so designed as to cause the least possible shock to passing vehicles; thus, they should never run at such an angle to the road that a fore and hind wheel will enter at the same time. A ridge of earth across the road makes a cheap substitute for a paved catch-water.

It being so important to drain from the road surface all the water that falls upon it, still more important must it be to prevent water from the adjacent land getting upon the road, thus making it a drain for the surrounding fields. Hence all streams, however insignificant, should pass under the roadway through culverts, instead of flowing directly across the road, creating a wash or mud-hole in summer and a sheet of ice in winter.

A cheap and serviceable culvert for small drains consists of several "V" shaped frames made of stout joists, and covered on the outside with thick planking. This is placed under the road with the points of the "V's" up, at the point where the stream crosses. Where a culvert is placed at any depth below the road surface, it will pay, in the long run to make it of stone or of concrete and rubble. Large culverts should be protected from the undermining action of the water by a rough paving of stone, and by rough wing-walls or piling at each end. Culverts should in all cases be large enough to admit of the passage of the greatest amount of water that may at any time require to be carried under the road.

Ample side ditches should in all cases be provided, for receiving and carrying away the water that drains from the road. Their size will depend upon local circumstances, but a width of one foot at the bottom, and a depth not less than three feet, with a side slope depending upon the stability of the soil, will generally be sufficient. In cuttings, and where hill-sides drain into them, they should be larger; and in swampy places they may be made large enough to supply the material necessary for raising the road-bed well above the natural surface of the ground.

Side ditches should discharge into the natural water-courses, and should have a longitudinal slope of at least 1 in 125.

On hill-side roads one ditch will generally be sufficient, and this ditch should be placed on the inner or up-hill side of the road, which should slope uniformly towards the ditch through its entire width; and in case of curves on such roads there should in no case be more than one drain, the inner one (a provision for the safety of descending vehicles).

This inner ditch may discharge at intervals through small culverts leading to the down-hill side of the road.

Water should never stand in the side ditches within less than three feet of the road surface; as otherwise it will soak into the sub-surface of the road, making it elastic and unstable, and will rise by capillarity to the surface. The more thoroughly to drain the sub-surface in flat, wet places, small covered drains may be placed across the road at intervals, at a depth of twenty to twenty-four inches below the surface. Ordinary drain-tiles may be used for this purpose.

Still further to insure a dry road surface, it should be exposed to the action of the sun and wind. Hence high walls and hedges along a road are objectionable, and shade trees are of doubtful advantage.

The proper width for a road will depend upon the amount of traffic over it; sixteen feet will generally be sufficient for the traveled portion, but the width between fences should be much greater to give sunlight and wind free access to the road. In excavations the road may be made narrow for economy.

The side slopes of excavations and embankments should be inclined at a little less than the *angle of repose* of the material dealt with, that is, the steepest angle at which the material will stand of itself. Solid rock may be cut vertically; common earth will stand at a slope of 1½; sandy soil at ⅓.

In deep cuttings the side slopes should be much gentler than the angle of repose; particularly on the south side of the road, to give the sun-light freer access.

The best outline for a side slope, either of an excavation or embankment, is a double curved surface, convex at the top and curved at the bottom, this being the form invariably assumed by a bank of earth when left to itself. Side slope should, in all cases, be sodded, sown with grass seed, or otherwise protected from the washing action of the water.

In deep excavations there should be a ditch just beyond the brow of the side slope on the upper side of the road, to carry off the water draining from higher ground, and which would otherwise run down the side slope.

On high embankments side ditches are still to be maintained, though they may be smaller than usual. These ditches may discharge at intervals over water-ways, roughly paved, and leading down the side of the embankment.

MAINTENANCE OF ROADS.

This will consist, for the most part, in keeping side ditches clean, culverts open, ruts and depressions on the road surface filled up, etc.

The material taken from the side-ditches in cleaning, should not, as a rule, be returned to the road-surface.

Neither should sod or vegetable mould be used for filling ruts on the road, as it turns to the softest mud in wet weather, and to impalpable dust in dry weather and is blown from the road.

It will generally be better to haul the material necessary for filling up ruts and depressions, rather than plough up or otherwise loosen a hard, travel compacted road-bed for smoothing off its surface. Says Gillespie: "The plough and the scraper should never be used in repairing the road. Their work is large in quantity but poor in quality. The plow breaks up the compact surface which time and travel have made tolerable; and the scraper drags upon the road from the side-ditches the soft and alluvial matter which the water had removed from the road, but which this implement obstinately returns to it."

It is important that all loose stones, down to half the size of a hen's egg, should be removed from the road.

The wheel of a loaded vehicle in passing over a stone not more than two inches high will, by its forcible descent, injure the road more than the natural rolling wear on a smooth surface in running a mile.

Every hole or rut in a road should be at once filed up with good material, for the wheels fall into them like hammers, deepening them at each stroke, thus increasing the destructive effect of the next wheel. But the principal reason why holes and ruts should be filled as soon as formed, is to be found in the fact that in wet weather these hold upon the road the water that would otherwise be at once discharged into the side-ditches, generally giving rise to mud-holes or troublesome washes.

A very good contrivance for removing loose stones, filling up ruts and leveling the surface of the road, consists of a stick of timber shod with iron and attached to its tongue or neap obliquely, so that it is drawn over the road quartering, and throws all obstructions to one side. The stick may be six feet long, a foot wide, and six inches thick, and have secured to its front, side, a bar of iron descending half an inch below the wood.

The importance of at once removing from the road any obstruction that chance may place thereon, of filling all ruts as soon as they appear, and of keeping side-ditches and culverts constantly clear, will ren apparent the unsatisfactory nature of any system of annual repairs. Add to this essential wrongness of principle the frequent incompetence of those in charge of repairs, and the laxity of discipline ordinarily maintained over those engaged in repairing, and we have as a result the notoriously poor roads of our country.

In 1868, the Department of Agricultute sent out circulars of inquiry concerning the roads of the country.

The information thus gathered is summed up as follows: "The immediate supervision of the construction and repair [of roads] is generally under the direction of local *road supervisors.*

"The tax for road repairs is generally a capitation tax on male citizens between sixteen and sixty years of age. Although this system of levying road tax generally prevails, it is conceded that it is very defective, and so long as it is continued, poor roads will be the inevitable consequence. Any system which provides for the assessment of a road tax in labor will be found inefficient and totally inadequate to the purpose for which such tax is levied. The recorded experience of reliable men in all rural districts in this country,—in some cases covering a period of more than two hundred years,—of the defects of the system, is sufficient evidence that reform is greatly needed."

These observations made in 1868, are of weight to-day, for the *supervisors'* system then generally practiced is the system in vogue at the present time. Thus, Mr. L. B. Pierce, in the Ohio Agr'l Rep. for 1881, writes:

"There are but two reasons why the present system [of constructing and repairing roads] should be continued. One is the familiarity of the supervisor with the road over which he daily travels; and the other, the opportunity which farmers have to apply labor instead of cash to maintaining the road. The objections are:

"First, ignorance of the true principles of road making; second, failure to get out all the work early in the season; third, the fact that the office is sought by those without qualifications, while the most competent avoid it [because of the insignificant renumeration]; fourth, the division of dependent roads by the boundary lines of different districts; sixth, the general badness of the roads under the present system.

"It seems to me that many of the evils of the present system could be avoided, or remedied, by putting the whole road business of a township into the charge of one person, selected for his qualifications, and employing paid labor.

"Such a supervisor would have the advantage over the present ones, in the fact that he would not be confined to a few days wherein to complete his year's work of repairing the road, but could do it as it became necessary, attacking the most needy jobs first. Little and often, and a shovel-full in time saves nine, are maxims which express in a few words much of the secret of good roads; and having a man with help whose special business it was to daily look after the roads, these maxims could be carried out."

Essentially the same system is proposed in the report of the Department of Agriculture for 1868.

Repairing the roads by contract with private parties, would offer, it is believed, some advantages over the foregoing system. It would insure the personal interest of the contractor in the quality of his work by stipulating that before any money be paid out for repairs the road under contract shall have been maintained in a specified condition for a specified time. It would relieve the government of the necessity of buying and taking care of a large stock of implements; such as scrapers, plows, shovels, etc. Above all, it would substitute private enterprise,—the genius of American progress,—for governmental inertness. The task of determining if the roads were maintained in the condition specified in the contracts could be performed by the county surveyor.

Either method would in a few years raise up a craft of road-makers, composed of men made masters of their profession by that exclusiveness of attention and undividedness of energies which,—and which alone,—are guaranties of excellence in any calling.

SKETCH OF GEOLOGY OF MISSOURI.

By, G. C. Broadhead,

Formerly State Geologist.

GENERAL GEOLOGICAL STRUCTURE.

In this State we find, either fully or partially developed, the following geological formations, the more recent in age at the top of the section:

1st. Quaternary.

2d. Carboniferous, including the *Coal Measures* and *Lower Carboniferous.*

3rd. Devonian.

4th. Upper Silurian.

5th. Lower Silurian.

6th. Archæan.

The Quaternary embraces the *Alluvium*, *Bottom Prairie*, *Bluff* or *Loess* and *Drift.*

The Alluvium furnishes the material for our soil, and includes the recent deposits which are forming every year along our streams, and are deposited at every overflow of water. It results largely from disintegration, decomposition and abrasion of older rocks, which becoming mingled with decomposed vegetable matter form soils. Along our river bottoms we often find, a little above high water, deposits of stiff, dark colored clays, which often inclose nodules of bog iron ore.

The Loess includes the pulverulent sands over-spreading the hills near the Missouri and Mississippi rivers, and their main tributaries, and for this reason it has been termed "*Bluff*," by the geologists of Missouri and Iowa. It gives character to the rounded hills all the way from St. Charles to Council Bluffs. It affords a subsoil for our most productive soils, and where especially well developed in Missouri, sustains a heavy growth of timber with many vines; and when cultivated, the soil yields fine wheat crops and fruit of a superior quality. This formation is not well developed away from our large rivers, and is not found on the high lands of South Missouri.

The *Drift*, or glacial deposits, includes beds of sand, clay and boulders of, chiefly, granitic rocks. It is found throughout North Missouri, but has been rarely found south of the Missouri river, nor have I any evidence of its occurrence farther off than fifteen miles south of the Missouri river.

THE UPPER CARBONIFEROUS, OR COAL MEASURES.

In Missouri are recognized three divisions,—the *Upper*, *Middle* and *Lower*. The *Upper* or *Barren Coal Measures* prevails throughout Northwest Missouri, west of a northeast and southwest line from Mercer to Bates county. It overlaps the Middle Measures, and the Middle rests upon the Lower Coal Measures. These latter, on their outcrop, occupy a belt parallel with the eastern extension of the Upper Measures, and varying from fifty to seventy-five miles in width, with the eastern boundary quite irregular, and sometimes extending much farther east, and reaching from Clark county in the northeast to Jasper in the southwest. In this are included our workable coals, so valuable in Johnson, Henry, Bates, Vernon, Barton, St. Clair, Lafayette, Saline, Carroll, Chariton, Howard, Boone, Callaway, Audrain, Ralls, Macon, Randolph, Linn, Sullivan, Adair, Mercer, Putnam and Schuyler. The coal of St. Louis and St. Charles is not connected with the other coal-fields, but is detached by the intervening Mississippi from the neighboring Illinois coal-fields. Our Southwest Missouri coals are particularly valuable; and I say now, as I did, fifteen years ago, that the metal workers of Missouri will have to look to Southwest Missouri for their chief coal supply. The best coals, which are also easily mined and of good workable thickness, also occurring under extensive areas, may be found in the counties of Bates, Vernon, Henry, St. Clair, Johnson and Barton. Bates county has already taken the lead in furnishing coal and establishing furnaces, and other counties will follow. The Missouri Geological Report for 1873–'74, contains close approximate calculations of the probable amount of coal in the counties of Southwest Missouri, and if any one will carefully examine that report he will conclude that our supply of coal is simply inexhaustible.

The Missouri coal-field embraces an area of 23,100 square miles, with a total thickness of about 2,000 feet, including the Upper Measures of 1,300 feet, and the Lower and Middle of about 700. Under an area of 8,000 square miles our best workable coals may be found, and may be mined chiefly at a depth of less than 200 feet below the surface. Besides coal, our Lower Coal Measures include valuable deposits of *clay ironstone*, which may yet become valuable; also *hematites* and *ochres*, but thus far none of them have been utilized. With but few exceptions, no particular analyses of these ores has yet been made, but their average per centum of metallic iron is as great as many that have been worked in Pennsylvania. When our southwest coals are more developed, the interstratified beds of *clay ironstone*, as well as of *fire-clays*, will be utilized. There are many valuable beds of *fire-clay* associated with our coals, that have not yet been used. Also good beds of hydraulic limestone, associated with, and overlying the coals. The sandstones of the Lower Coal Measures form inexhaustible supplies of dimension rock for building, and are being extensively shipped to distant, points from Johnson, Bates and Carroll. They also form a superior article, both for building purposes and for grindstones; for example, the rocks of Jasper, Barton, Cedar, Henry, Vernon, St. Clair and other counties.

The Carboniferous formation of North America attains its greatest thickness in Nova Scotia, reaching to 14,570 feet; and includes seventy-six coal seams and dirt beds, indicating that number of periods of vegetable growth.

THE LOWER CARBONIFEROUS.

In Missouri the Lower Carboniferous is divided into the following groups:

Chester and Ferruginous Sandstone;
St. Louis and Warsaw;
Keokuk;
Burlington, or Encrinital;
Chouteau, including *Chouteau Limestone;*
Vermicular Sandstone and Shales; and
Lithographic Limestone.

The buff sandstone quarried a few miles from Ste. Genevieve, Missouri, is of Chester age, and is one of our very best sandstones for building purposes. It was used in building the approaches to the St. Louis bridge, and the only objection to it, is its being so readily soiled. Good grindstones have been made of it. It affords a fine flagging material on Oliver's Prairie, Newton county. It forms an excellent quarry rock near Boonsboro, Howard county; and also near LaMonte, Pettis county; and near the road from Marshall to Boonville, near county line of Saline and Cooper.

In other parts of the State it is more often a *ferruginous sandstone*, not particularly valuable. But in Greene county it contains valuable iron ore.

The St. Louis Limestone (or group) is well developed in St. Louis, St. Charles, Ste. Genevieve, Lincoln, Knox and Lewis. It has proven itself a good stone for foundations, and many beds form very durable structures. Of such, St. Louis affords many examples. Some of its beds will do for lithographic purposes; some beds make good hydraulic lime, and an excellent quality of lime is made in the city of St. Louis. It also affords some rare and very beautiful fossils, as the "*Melonite;*" and quarries in St. Louis have yielded *carbonate of lime*, *sulphate of lime*, *sulphate of baryta*, *fluate of lime*, and, rarely, beautiful crystals of *millerite*, a hair-like crystal of *sulphide of nickel*.

The *Warsaw* division was at one time separated from, but is now recognized as a subordinate division of the *St. Louis* group, occurring at its base. Its shaly beds sometimes abound in that beautiful spiral shaped fossil, the Archimedes (or Archimedes screw). These abound at Boonville, in Howard county, and at Moscow Mills, Lincoln county.

The "Keokuk" group is found in Eastern, Central and Southwest Missouri. It is well developed in St. Louis, St. Charles, Lincoln, Pike, Clark, Monroe, Boone, Audrain and Howard counties, and the lead region of Southwest Missouri. The limestones are generally of a bluish gray color, and coarse texture. It incloses some thick *chert* layers; and in Northeast Missouri and at Keokuk, Iowa, there are shale beds containing numerous *chert* concretions, generally hollow in the interior, and lined with beautiful crystals, of different colors of *quartz*, *calcite* and *fluorite*. The limestones, when free from *chert*, burn into a good quality of lime, and are thus extensively used in Jasper, Newton, Lawrence and Greene counties. They also afford beds of good building stone.

At Neosho we find a thick bed of white, easily worked *oölitic* limestone. The *Tripoli* beds of Newton county are porous *chert* beds, and belong to this group.

The valuable lead and zinc mines of Jasper, Newton, Lawrence, Greene and Dade counties, Missouri, and near Galena, Kansas, occur in this group. These deposits are practically inexhaustible, notwithstanding the fact that a great deal of mining has been prosecuted in these counties, more especially, at Granby, Joplin, Short Creek, Webb City, Carterville, Lehigh and Oronogo. New discoveries are all the time being made at these mines, and the yield of ore has been immense. Only the low price of mineral at present, is a drawback to more active energy.

The Burlington group is well developed in Northeast Missouri, being found in St. Louis, St. Charles, Lincoln, Pike, Ralls, Monroe, Marion, Warren, Montgomery, Callaway, Boone, Cooper, Howard, Pettis, Cedar, Dade, Greene, Christian and Lawrence. It is generally a pure limestone, but contains some *chert*, the lower beds generally being *ferruginous*. It burns into elegant lime, and affords useful beds for building purposes. Its middle portion generally occurs in thick, light gray layers. The columns of the Missouri University building at Columbia, are built of this limestone, and are as good now as when first put up, forty years ago. Some of the limestone used in the foundation beds of the Custom House in St. Louis are of rock of this age, but was obtained from Quincy, Illinois. Good quarries of this rock are exposed at Hannibal and Louisiana. Many large caves in Kentucky and Missouri lie in the Burlington and St. Louis group. The cave on Sac river, in Greene county, occurs in this group. The *St. Louis Limestone* around St. Louis, and in St. Charles county, is especially cavernous, as shown by the frequent occurrence of sink holes. The castellated escarpments of rock on the Meramec river, and other similar occurrences on the Mississippi, are variations of scenery due to the weathering of the Burlington limestone beds.

The lowest member of the Lower Carboniferous system is known in Missouri as the *Chouteau* group, and comprises three principle members: the *Chouteau Limestone*, *Vermicular Sandstone* and *Shales*, and *Lithographic Limestone*. The last named only resembles a lithographic limestone found in Northeast Missouri. At Louisiana it is best developed, and at that place slabs can be quarried, answering every purpose of the lithographer. Below Hannibal it is also well developed, and the cavern known as McDowell's Cave occurs in it. In Southwest Missouri, and on the Osage river in St. Clair county, it presents the character of a buff-brown *dolomite*.

On the Meramec, in St. Louis county, the limestones have well marked red beds.

The *Devonian* is not extensively developed in Missouri. A red sandstone occurs in the southwest part of Warren, and a black slate is thinly represented in Pike and Ralls, near the Mississippi. But although this slate is somewhat bituminous, persons must not be deceived into believing it to indicate the presence of coal. In Callaway and Pike county interesting fossil corals are found in this formation. This is the representative in Missouri of the well known hydraulic limestone of Louisville, Ky., and similar beds may be found in the eastern portion of Callaway county.

The *Upper Silurian* is also but sparingly developed in Missouri. In Pike county, buff limestones affording good building stone, occur. A similar rock is extensively quarried at Grafton, Illinois, and is very much used in constructing the sewers of St. Louis.

Liver colored marble beds of the same geological age, crop out near Cape Girardeau, Missouri, and are also found in Ste. Genevieve county. A *Crinoidal* limestone, which probably is Upper Silurian, affords a good fire-rock in Montgomery and Callaway counties.

Next to the Carboniferous, the Lower Silurian is the most important system of Missouri. The Carboniferous occupying over one third the area, the Lower Silurian over one-half. Nearly all of South Missouri below the Osage, excepting the western tier of counties and part of a few others just east, with St. Louis county, the Swamp counties and part of the River counties, is occupied by

THE MAGNESIAN LIMESTONES.

In the counties of Ralls, Pike, Lincoln, St. Charles, Warren, Montgomery, eastern part of Callaway, also in Franklin, St. Louis, Jefferson, Ste. Genevieve, Perry and Cape Girardeau are found the upper members of the Lower Silurian system. In Ralls, Pike and Lincoln are about 100 feet thickness of calcareous flagtones and shales, often very much impregnated with sulphuret of iron. The sulphur springs of these counties originate from these beds. Below the Hudson River beds lies the *Trenton* group, divided into the *Galena Limestone* or *Receptaculite* beds at top; next below, the *Treuton* proper; and still below, the *Black River Limestone* beds. The Receptaculite Limestone of Missouri corresponds to the Galena Limestone of Northwest Illinois, in which the lead ores of Northern Illinois, Southeast Iowa and Southwest Wisconsin occur. In Missouri we have thus far no record of this rock being lead-bearing, Its greatest observed thickness is in Cape Girardeau county, Missouri, where it is about 130 feet thick. It forms a good building stone, but is most preferred for burning into lime, as it forms a good, strong, white lime. For this purpose it is extensively quarried at Cape Girardeau, at Glencoe, St. Louis county and in Jefferson county at Kimmswick. From near the latter place, it was formerly quarried and used in the public buildings of St. Louis. The face of the MacPherson building on Fourth street, St. Louis, was constructed from it, also part of the St. Louis court house. The gate posts at Lafayette Park are of limestone from Glencoe. The people, or owners of the

Glencoe quarries at one time were filled with bright anticipations of its future use as a marble, but were doomed to disappointment, as it was quite deficient in many of the most desirable qualities of a good marble. But it is excellent for burning into lime.

The State House at Baton Rouge, Louisiana, was constructed of this rock, quarried at Cape Girardeau. This building was burned during the war, and a few years ago this stone was again used in its repair, showing the quarry to be valuable. From the almost constant occurrence of a beautiful fossil in its upper portion, Dr. Shumard applied to it the name *Receptaculite limestone.* In some parts of Missouri it is quite cavernous, for instance in Lincoln, Pike and Ralls. We might name Fisher's cave in Ralls, and Natural Bridge on Cuivre river in Lincoln. The *Middle Trenton* beds next below, are about 130 feet thick, with 70 feet of "Black River" Limestone still below. The *Middle Trenton* beds are unimportant, excepting where they contain interesting fossils. They contain large *Trilobites* and *Orthoceratites.*

The beds of the "Black River" Limestone are in thicker layers, are more crystalline, and afford an excellent building material. They are often beautifully mottled, sometimes with red, and would make handsome marble. The Magnesian Limestones lying below the above rocks, as I have above said, occupy very nearly one-half the area of the State of Missouri. In Central Missouri four divisions of limestone, separated by sandstones, have been recognized. The borings in the well at the Insane Asylum, St. Louis, show five magnesian limestones and five sandstones. In Central Missouri we have:

The *First Magnesian Limestone*, 50 to 130 feet;
The *First or Saccharoidal Sandstone*, 40 to 133 feet;
The *Second Magnesian Limestone*, 140 to 300 feet;
The *Second Sandstone*, 40 to 130 feet;
The *Third Magnesian Limestone*, 300 to 600 feet;
The *Third Sandstone*, 30 to 50 feet;
The *Fourth Magnesian Limestone*, 300 feet; from 600 to 1,700 feet in all. The borings of the Insane Asylum well foot up 2,192 feet of strata.

The "Magnesian Limestone" series prevails throughout Southern Missouri, and occupies the most elevated portions of the State, rising to 1,500 feet above the sea in Webster county, and forms the greater portion of the Ozark plateau, and formed a large island during the long period occupied during the deposition of the more recent Paleozoic rocks. Most of the lead of Central and Southeast Missouri is found in the "Third Magnesian Limestone," some also in the "Second Magnesian Limestone," and the lead and zinc deposits of Northern Arkansas are probably of the same age.

The counties chiefly abounding in these ores are Washington, Jefferson, Crawford, Franklin, Miller, Cole, Morgan and Benton, with scattering deposits in other counties.

The ores in these rocks occur in pockets, openings, chimneys, lodes, veins or crevices, or else in softened and broken portions of the rocks. When in lodes or veins the course is generally nearly north and south, as at Sandy Mines, Virginia Mines, Cole Camp and Dolph Mines.

The *First or Saccharoidal Sandstone* is known in Northern Illinois and Wisconsin as the *St. Peter's Sandstone.* It is generally of a pure white, more often soft and easily quarried out, nearly pure silica, and affords an excellent material for glass making. For that purpose it is used at the Crystal City glass works, where it is 75 feet thick. In the western part of St. Charles county it is 133 feet thick, and it is also quite white. It can be traced across the country from the mouth of Plattin creek, Jefferson county, to St. Charles county; thence up and along the Missouri bluffs, thinning to the westward, being not over 20 feet thick in Callaway county. For glass making it affords an inexhaustible supply, and the State of Missouri is probably better supplied with material for that purpose than any other State in the Union. It occurs over a limited area in Lincoln, Pike and Ralls. A good quarry of it is operated at Pacific.

The "Third Magnesian Limestone" is often cavernous, and large caves and natural bridges are often met with where these beds are well developed. Such are found in Maries, Pulaski, Ozark, Taney, etc. The chief sources of the magnificent streams of Southern Missouri lie in these beds, especially of White River, Black River, Current River, Gasconade, Niangua, and their tributaries.

But few quarries of these limestones have been worked, yet there are numerous thick beds of very valuable stone in this formation. The "Second Sandstone" often contains valuable iron deposits.

In Madison county the base of the series is represented by as much as 175 feet of *dolomites* and *grit-stones.* These beds contain the valuable deposits of lead, nickel, cobalt and copper of Mine la Motte, Madison county, and the St. Joseph mines in St. Francois county. The ores here occur chiefly disseminated in the horizontal beds of limestone, or in flat sheets between.

Below the last are the beautiful beds of variegated marble, found in Iron, Madison and Reynolds, and known as *Ozark marble.* At the base there is also found in these counties, from a few feet to 90 feet of sandstone, which rests directly on *granite* or *porphyry.* This sandstone then is the oldest unaltered rock found in Missouri, and is equivalent in geological age to to the "*Potsdam*" of New York, as also are the marble beds and the limestones containing the lead ores in Madison, St. Francois and Reynolds counties.

The "First Magnesian Limestone" is not well recognized, excepting in counties near the Missouri and Mississippi rivers, but it often affords a very excellent building stone. Very good quarries may be opened in Ralls, Pike, Lincoln, St. Charles, Warren, Montgomery and St. Louis counties.

The *granites*, *porphyries* and their associate beds are *Archæan* and may include *Laurentian* and *Huronian* rocks. The chief outcrops of granite are in the northern portions of Iron and Madison, the southern portion of St. Francois. with isolated exposures in Ste. Genevieve and Crawford. The granite near the Iron Mountain railroad, and that also near the line of Iron and Madison counties, is coarse grained, and a handsome red *feldspathic;* that near Knob Lick, of a grayish red, and a beautiful gray *syenitic;* that near the Iron Mountain railroad, in the northern part of Madison, is a dark, reddish gray *porphyritic.* Our granites do not contain much *mica*, but are chiefly composed of *quartz* and *feldspar.* The *porphyries* cover a greater exposed area, and are the prevailing rock over a large portion of Iron and Madison counties. They are also exposed in Washington,St. Francois,Reynolds and Wayne with a few limited outcrops in the neighboring counties. They are generally fine grained, sometimes *crypto-crystalline*, mainly composed of *feldspar*, and also contain crystals of both feldspar and quartz. Their color is generally a dark red, sometimes shading into black or gray. If polished they would form a beautiful stone either for building or ornamental purposes, table tops or mantles. Joints and clevage planes are often a hinderance to the successful working of them. Nevertheless good quarries can be opened. We have seen specimens of this rock as beautiful as the famed antique porphyry. Other beds are as handsome as the Russian, Sweedish or Norwegian porphyry. But all of them would be expensive to polish. With these rocks we also find *diorite*, *epidote*, *hornblende* and *serpentine*, as well as beds of *specular* and *magnetic* iron, and veins of *quartz.* The ores of Iron Mountain, Pilot Knob and Sheppard Mountain lie in *porphyry. Galena*, *zinc-blende*, *tungsten*, *pyrite* and *argentiferous galena* occur at several places.

At the Einstein Mine, on St. Francis River, we find *granite*, *porphyry*, *diorite quartz*, *fluorite*, *serpentine*, *pyrite*, *zinc-blende*, *argentiferous galena* and *wolfram.*

In the northern part of Madison, Iron and Reynolds counties, quantities of loose, black sand are found—this is magnetic iron.

The porphyry mountains of Southeast Missouri rise from 300 to 660 feet above the valleys, and the testimony of the rocks goes to show that, previous to the formation of the sandstone and limestone, the country presented the appearance of porphyry knobs, rising 1,000 to 1,500 feet above the sea; while around their base the "*Potsdam*" sea roared and raged, and tore great masses from the mountain sides, which were disintegrated and rolled in the waters, and afterwards solidified into the coarse, pebbly sandstone now found there, resting upon the porphyry hills.

It is only during recent years that much attention has been directed to the quarrying of Missouri granite. This industry is yet in its infancy, and the rock chiefly used has been obtained from near the surface. Quarries are now worked near the Iron Mountain railroad near Knob Lick. In the northern part of Madison, and in Wayne county, a dark *syenite* is quarried.

Pleasant Hill, Mo., October 10, 1885.

HORTICULTURE ON THE FARM.

BY L. R. TAFT,

Professor of Horticulture, State Agricultural College.

The experience of the year which is now drawing to an end, should be sufficient to convince the farmers of the State of the need of a greater diversity of crops. A large proportion at present depend upon wheat as their sole money crop, and the failure of the past year has not only fallen heavily on the farmers themselves, but has indirectly injured every other industry.

However, misfortunes never come singly, and as the bad luck of the farmers will have it, the price of beef and pork, upon the growth and sale of which many of them depend to help out their income, has dropped to a point at which the margin of profit is very small.

When a diversity of crops is grown, a farmer does not feel such losses as much as he does when he depends upon one or perhaps two crops. Realizing the truth of this, many farmers have taken to growing a number of money crops.

The keeping of dairy cows for the production of milk, butter or cheese; of sheep, for wool or mutton; the raising of sorghum, flax, buckwheat, etc., have all received attention, and in many localities are the best selections that can be made.

To such as like the pursuit, horticulture offers a broad field from which to choose.

The word horticulture, as commonly used, signifies the growing of fruit, vegetables and flowers, and the plants by which they are produced. Taking this as our definition, the subject at once widens out to include market gardening, orcharding, grape growing, small fruit growing and the green-house and nursery business. As each of these branches includes a number of specialties the choice is no small task.

MARKET GARDENING.

A farmer who lives within five miles of a good market can select no more profitable system of husbandry than garden truck. But it is unwise for a person to engage in it on a small scale, as the expense of marketing his product will swallow up the profits. Neither should a farmer engage in market gardening on a large scale, unless circumstances are in his favor; the land should be adapted to the purpose; manure easily obtained; the market a sure one; and the man himself should be thoroughly posted in all its details and prepared to make it his business. He must be willing to work, in season and out of season, rain or shine.

On the other hand, for the man who understands the business and gives himself to it, no other department of horticulture is more profitable. For the ordinary farmer there are various specialties which he can grow with profit and which will assist to swell his income. Such crops as the onion, parsnip, cabbage, sweet corn, tomato and pea, can be grown cheaply on a large scale, and can be turned over to commission merchants and marketmen or sold at once to consumers.

SMALL FRUITS.

The growing of small fruits has proved very profitable in some localities. The red and black raspberry, the strawberry and the blackberry ripen in succession, and are a source of income for three months in the year, while the sale of surplus plants will often pay for the entire cost of the bed.

The opinion is general that small fruits do not pay in country towns, but if a live person goes into the business he will be surprised at the trade he can work up; further, if the berries are properly picked and packed they can be sent by rail for a long distance.

VINEYARDS.

The cultivation of grapes for wine, or for the table, is very remunerative in many sections of the country. For several years, however, the grape-rot has played such havoc with the crop in Missouri that many persons are tearing up their vines. The use of paper sacks will generally secure a crop; but when the price of grapes in the cities is as low as two cents per pound, the slight expense for sacks and the labor of putting them on will often take up the last cent of profit.

The commission merchants of St. Louis receive carloads of grapes from the "lake region" of Ohio, where the rot has not manifested itself to any extent, and are able to put them on the market at a price which is ruinous to the ordinary growers here, who expect a return for the planting and care of the vineyard, for sacking and gathering the fruit, for baskets, and perhaps for expressage and commission, in addition to the interest on the investment. Notwithstanding this and other drawbacks, we believe that grape-growing is still profitable here. By getting a reputation for growing fine fruit, a man can easily dispose of his crop at an advance on the market price. The quality of the fruit, the size and appearance of the bunches, and the neatness and taste shown in preparing them for the market, will make a great difference in the price they will bring. One drawback is, that the finest grapes are not hardy here, and they also suffer badly from the rot. A little extra attention in winter protection and in sacking, will overcome this, however.

Grapes can also be grown successfully in small towns remote from trade centers, for the purpose of supplying the local demand.

ORCHARDING.

The growing of apples by farmers who are distant from a market but are supplied with railroad facilities, should be more generally engaged in. A man in this pursuit, with a small outlay of time and money, can after a few years reap regular and increasing dividends. The number of enemies which menace this crop exceed, perhaps, those attacking any other. From the time the trees are planted constant watching will be necessary, to save them from these pests. In the winter they must be guarded from the attacks of rabbits and mice; and in the summer, when the borer and its one hundred and fifty insect allies are on the war path, these must be attacked and exterminated. In some seasons, when the temperature and moisture are such as to invite their development, the fungoid and algoid enemies of the apple are still more to be feared.

The peach, pear and plum require even more attention than the apple, but the greater value of the crop will well repay the extra attention.

Nothing has done more to keep down the fruit interests of the State than the swindling operations of the nursery agents, by whom so many of our farmers have been victimized. Many so-called "tree agents" are perfectly honest and reliable, but the majority of them cannot be trusted. Sometimes worthless varieties of trees are furnished with a high-sounding or Russian name, and sold for five times the price of the standard varieties, or exorbitant prices are charged for trees which have been made borer or blight proof by some new method of propagation.

Further, farmers trust too much in the advice of these men, forgetting that their business is to *sell* trees; that they have learned their lesson, and parrot-like repeat it. When a few trees, only, are desired it is advisable to purchase them of a *trustworthy* canvasser, but if a purchase is to be made, the trees should be purchased direct from the nursery.

FORESTRY.

When we consider the rapidity with which the country is being denuded of forests, and the high price of lumber in this State, it would seem that there could be no more useful or profitable investment than a timber plantation.

The rapid growth of the catalpa and larch, and their value as fence posts, railroad ties and telegraph poles unite to make them desirable for timber growing; while the walnut, ash and white pine will in time make valuable plantations.

The young seedlings can be grown in nursery rows and transplanted, or can be purchased from nurserymen at very low prices.

From this brief *resume* of the branches of horticulture which can be profitably taken up by the farmer, it will be seen that their successful cultivation requires close attention, and a knowledge as to their requirements which few farmers possess. The increased income, however, resulting from their cultivation, will well repay for the extra attention; and the requesite skill can be acquired by growing the crop selected for a year or so on a small scale, and profiting by the experience thus obtained. Profit also should be made by the experience of others This can be easily and cheaply obtained through the numerous horticultural books and periodicals, which contain the experience of some of the oldest and best horticulturalists of the country. As being among the best works on this subject, we may mention "Barry's Fruit Garden" or "Thomas' Fruit Culturist", and Henderson's "Gardening for Profit"; and of the periodicals none are more useful than the "The Fruit Recorder" and "The American Garden."

At the present time all the leading agricultural weeklies of the country devote a page to horticultural affairs. This is generally edited by a practical gardener or fruit grower, and from it very useful ideas can be obtained.

The Annual Reports of the Missouri State Horticultural Societies, and of the State Board of Agriculture, contain useful information on various subjects relating to horticulture, and will amply repay a careful perusal.

Even if a farmer does not care to engage in any branch of horticulture as a source of income, he should set apart a small portion of ground near the house as a vegetable and fruit garden. If properly arranged and planted, but little hand cultivation will be required, and it should yield a variety of vegetables for family use; and such fruits as the strawberry, raspberry and grape; while a small bed of asparagus and pieplant will help to bridge over the gap which often occurs before the new vegetables and fruits appear. These together with a few trees each of apple, pear, plum and crab will furnish such a variety for the table as will tempt the appetites and improve the health of the family.

Each of the children should be assigned a little piece of ground, which they should be encouraged to cultivate, and thus learn their first practical lesson in horticulture.

The good wife and daughters should be assisted about their flower beds, as they will be a source of pleasure to them and an ornament to the farm; while a few pot-plants in the living room will serve to brighten it up during the winter months.

FARMERS' INSTITUTE MEETINGS OF THE BOARD.

MEETING OF THE BOARD AT MARSHALL.

A Farmers Institute meeting was held at Marshall on December 8th and 9th.

A part of the report of the proceedings of this meeting was abstracted from the Kansas City Live Stock Record, which part appears in quotation marks.

"The Farmers' Institute held here Tuesday and Wednesday, under the auspices of the State Board of Agriculture, was a success considering the inclemency of the weather. It sleeted Monday night, making it hard to move about, and snowed Tuesday night.

"Yet notwithstanding this drawback there was a very good attendance of near-by farmers and town people. Among those noticed the first day were: Dr. S. S. Laws, President of the State University, Columbia; Prof. J. W. Sanborn, Dean of the State Agricultural College; W. E. Coleman, State Superintendent of Public Schools; M. Fairchilds Doud, Kansas City; and J. A. Potts, Mexico, Mo.; members of the State Board of Agriculture; and Dr. Paul Paquin, State Veterinarian.

"The handsome court house was thrown open for the occasion and everything done to make the meeting a success.

"About eleven o'clock Tuesday the Institute was opened by Mayor Jno. G. Miller, who spoke the following kind words of welcome: 'We meet here to-day, gentlemen, in the interest of agriculture, and considering we are pre-eminently an agricultural people, it is meet and right that we should take a lively interest in these institutes. I extend a hearty welcome to all present, and extend to you the freedom of our city. While we are sleet-bound to-day, yet the outlines of our county still show us to possess one of the prettiest spots on earth. And if you will come to us in the spring-time, when our fields are one velvet carpet of green, with our rich herds and flocks feeding at rest, and waving fields of golden grain seen on every hand, you will pardon me for my enthusiasm and admit that half has not been told. Yet enough can be seen to assure you of out great future, and I think I can claim for our farmers the foremost rank among western agriculturists in a few short years.'

"Prof. J. W. Sanborn thanked the Mayor in a few well-chosen words for his generous welcome.

"M. Fairchilds Doud then took the chair and announced the object of the meeting. He said it was for the purpose of promoting agriculture in all its branches, and to encourage a higher class of farming."

Mr. Dan'l Isgrigg, who was the first speaker announced, addressed the meeting as follows:

Gentlemen of the State Board of Agriculture—Fellow citizens:

There are periods in the life of every citizen when the occasion thrills his heart with unusual pleasure—and lifts him as it were to a higher plane. A time when he seems to escape from the ruts of his ancestors, and enter new fields of observation and enterprise that send the currents of life bounding throug his veins with unwonted alacrity.

As with persons, so with communities—and especially those communities where an intelligent enterprise and commendable ambition is struggling for higher and more desirable attainment.

Tho present occasion reminds us, that we, as an agricultural people, in common with such communities throughout our country, are looking forward, and struggling for that position among our fellows which an enlightened yeomanry have a right to claim and expect.

There is no period in the history of the world when the importance of agriculture was not recognized and appreciated, yet the tiller of the soil himself, with horny hands and sun browned skin, has ever been ignored by what we have been pleased to call the better classes—such as professional men, merchants, mechanics, and the multitude of enterprises that live and fatten upon his industry. His productions are recognized as the foundation of the great structures which are the pride and glory of civilization; himself, the "mud-sill." He has been and is yet, to a great extent, a common "clod-hopper." Yet civilization could not exist without him. Schools, colleges, churches, cities and all the evidences of intelligent civilization in existence would fall, fester and decay, without the primary help of this necessary calling.

It lies at the foundation of the structure of human greatness. It was founded by the great Architect of the universe; and first practiced in the garden of Eden, by the first and the happiest pair of the human race. It has given reputation and character to every nation of the earth from that time to the present, and to day, those nations and peoples whose domestic industries and enterprises are in the most advanced condition, are the most intelligent and happy. For us, there is dawning a better day. Scientific farming in all its departments is taking the place of the traditions of our ancestors. Book farming is not now, as of yore, the jest of the cultivator of the soil. Scientific methods are lessening our labor, increasing our profits, and giving respectability to our occupation, and ere long we will not only have a Bureau of Agriculture among the departments of State, but agriculture will be honored with a Cabinet position in the great counsels of our great country.

Recognizing these facts, and our motto being onward and upward, we hail with more pleasure than we can thus briefly express, the honor of your presence among us.

It is our opportunity, and we hope every person in our community who is engaged in the cultivation of the soil, the rearing of stock, the production of butter and cheese, or in any of the numerous branches of our occupation, will avail himself of the benefits which we expect to result from this meeting. And in their behalf, as their representative on this important occasion, we bid you a hearty welcome, not only as our teachers in these special callings, but as our honored and worthy guests. And allow us to hope that our acquaintance may be profitable to ourselves, mutually pleasant, and lasting as the high calling in which we are engaged.

" Prof. J. W. Sanborn followed Mr. Isgrigg.

" He said he was pleased with the attendance considering the inclement weather. As a member of the Agricultural Board, and as its Secretary, he felt proud of the welcome they had received at their hands. He was glad to say that agriculture, which is both a science and an art, is being given a greater recognition. These meetings, he said, had been organized but three years. When he started he had but $1,200 a year to work on, but through the generosity of the last Legislature was given $2,500. But with that they have to issue their reports and pay out other expenses. The object of this Board, he said, is to encourage a higher agriculture, and to better educate the farmer and his wife. He then adverted to agriculture during the early periods of the world's history. There were always large land proprietors, he said, but the masses were looked down upon. The Egyptians called farmers *stinking masses*. But the Romans at one time formed an agricultural aristocracy, and they were the proudest people of the country. And a good farmer was thought more of than a general. But this was upset by the lands passing into the hands of a few, wh created a farm peasantry; and the farmer then lost his intellectuality, and became noted simply for his muscle. Coming down to the present time, he spoke of the country boy leaving home for a city position, and looking back and sneering at his former home. 'I have had farmers say to me that they proposed to educate their boys so that they could follow some other occupation.' This was a great mistake. It took as much intelligence to run a farm rightly, as to manage a mercantile establishment or practice law successfully. He said he classed himself among the farmers, and hoped some day to retire upon a farm of his own. He spoke of the development of mechanics and the sciences, and said this marvelous growth of city life was owing to application, and a desire to elevate their business. 'What have farmers been doing during the same time'? he asked. 'Has farming kept pace with this growth? No. Why? Because farmers have sneered at science and refused to call it to their aid, as your city friends have done. I am happy to say a change is taking place. I expect to see the day when men will rather seek the country than the city, as now.' He spoke of what Sir Humphrey Davy had done for agriculture in the way of developing agriculture chemistry, and its great benefit to farmers. As an illustration of the interest taken in agricultural matters abroad and what was thought of scientific farming, he cited Sir John B. Laws, who he said had inherited a large fortune, yet was devoting himself to agriculture, and spent $15,000 a year in agricultural experiments. He advocated farmers going to the field with tape-line and scales, and studying farm matters more closely if they would reap the greatest results. He said that the color, number and weight of seeds had their influence upon plant growth. In Germany more than in any other country these matters had been studied, and the result was better yields and more profitable farming. In that country there were now seventy agricultural experiment stations, and it was no larger than Missouri. There were but fifty of these stations in the United States, but the speaker hoped to see twice as many in a few years. He said there was no such movement going on in any other branch of life as is now going on in agriculture, and he expected to see experiments pour in upon, the country from every quarter, and they should be watched and studied. He said he farmed upon scientific principles, and had always made money on the farm. There were no books on agriculture out of which some good could not be had. He wanted the farmer educated as well as other people, that he might feel he was the equal of any one. If you have a fair, you have a lawyer to preside, which implies that you feel your unfitness for such duty. The better education of the farmer would change all this. 'I agree with

Bob Ingersoll, who said that the green fields were better than the paved streets.' He next touched upon the material life on the farm. He spoke of the man first, and said his better education meant a material benefit. But he did not intend to slight the wife and daughters, as they too, could derive benefits from a higher education. He said that the Saline county farmer who stated that he could not afford to indulge in advanced agriculture, made a mistake. He could not afford to continue in his present way of managing his farm. It had been his lot to meet many farmers the past few years, and from as many as five and six different States, and he had found that where nature had done the most, there the farmer had done the least. The average yield of corn in Missouri was thirty-one bushels. 'Now, my friends, those yields are not the yields of good agriculture. Go with me to New Hampshire, she beats us both in wheat and corn, which is due to better farming.' He said Scotland, with all its rocks, made thirty bushels of wheat on the average, and the best farms as high as fifty bushels per acre. 'You here simply tickle the soil, you do not till it. I say this in all kindness. What is the possibility of your farm? I believe it to be fifty bushels of wheat and 100 bushels of corn, seventy bushels of oats and six tons of hay. You ask: How shall we make these yields? I will recommend a line of farming to accomplish it, and there is not a man in this house who can't do it. You have both the capacity and the land. Rotate your crops. England commenced on a lower basis than you, seven bushels of wheat to the acre. Why shall we rotate? Because each crop requires certain elements. You grow clover that sends its tap roots down to a great depth, to loosen up the earth. I would first plant corn, second potatoes and clover third, after which you can sow wheat. Wheat takes out different ingredients; twenty-five bushels of wheat contains forty-two pounds of nitrogen, twenty-four pounds of potash and twenty pounds of phosphoric acid. Ten tons of barn-yard manure contains 130 pounds of potash, 120 pounds of nitrogen and sixty-five to seventy-five pounds phosporic acid. Now a rotation of crops to exhaust these elements is a simple mathematical proposition. The thing to be done is to use this plant food to the greatest advantage. There are narrow and wide leaves and they feed differently. Take a licometer and stick it in the soil and you will find ample nitrogen, but it will have no influence on corn; but such soil will make a double yield of wheat. I might go on and elaborate on this subject, but it is getting late.

'I also insist on good barns and cellars. The man that allows his liquid manure to waste, loses 50 per cent. of its value. It is folly for us to say we don't need manure. Saline county needs better barn building and arrangements for saving manure.' He believed that a farm of 160 acres in this county could be taken and made to pay $5,000 to $9,000 per year. 'I would plant 16 acres to wheat, which should yield 50 bushels per acre, or 800 bushels; 16 acres to corn, which should yield 100 bushels to the acre, 1,600 bushels; 16 acres to oats, which should yield 70 bushels per acre; 16 acres to clover, and 32 acres to timothy, which should yield four tons to the acre. I would sell my wheat, but feed everything else, and save my manure. I would feed cattle and hogs, and make money. Besides hay, I will have 4,800 tons of corn-fodder, which is good roughness. I would keep 40 cows, which should make 200 pounds of good butter; 40 calves; 40 two-year old steers; 100 hogs and 100 sheep, from which I would get a good crop of lambs and a nice clip of wool. I am no dreamer. I am confident this can be done. The State of Missouri has never given one cent to the college farm, and it was in such a condition when I took it that I don't think it would have paid your way, yet by scientific farming I have made it pay its way, and I have spent $400 in experiments. The poor averages of yields of corn and wheat, given in the early part of my address, are your averages, not mine.'

"Dr. Laws, of the State University, paid a high compliment to Prof. Sanborn and his successful work.

"Adjourned for dinner."

AFTERNOON SESSION.

"Two o'clock found the court-house again fairly filled, there being a much better attendance than at the morning session.

"Prof. W. E. Coleman called the meeting to order and introduced Dr. Paul Paquin, the State Veterinian, who spoke upon diseases of animals. He sarted by saying: 'Undoubtedly you would like to hear a more authoritative voice than mine, but I am willing to add what good I can to the farming interest, out of the little bag of knowledge that I possess. I don't think I say too much when I say that I do not think that agriculture receives one-tenth the recognition it deserves, but fifty per cent. less than any other interest I know of.'"

The Doctor then gave a very able discussion of hog cholera (*swine-plague*), black-leg, parasitic bronchitis and dry-murrian; but as these diseases are treated of in his official report, his remarks are not repeated here. (See pages 210–225).

Numerous questions were called forth by the address.

"Some farmer asked what he would do when cattle were foundered on corn-fodder.

"The Doctor said that the blood-vessels of the hoof were conjested, as also were the lungs and bowels. If there is much bloating, change food and puncture the paunch. You might cut a hole in the side half way between the hip and the last rib, and put in a quill and let the air out. Another treatment that may be resorted to, is wetting a blanket in hot water and applying it on the body and chest, and putting a dry one over it. This operation should be repeated. Where lungs is affected give aconite.

"Mr. John Roe, of Mt. Leonard, wanted to know about *bloody murrain*. He said that the cattle he had seen affected with it showed a sickly appearance, and moped around, and the urine was bloody; a cough seemed to be connected with the disease. A clot of blood was found on the back. He has taken the hide off of such cattle and found much blood.

"Dr. Paquin—This seems to be a form of anthrax, from the symptoms given. As to the treatment of those diseases, we know nothing at all that will cure after they have the disease well developed.

"Mr. Roe—I have used slacked lime, and thought it proved a preventive. I have also used soda and lard to advantage. I think I have a sure-cure for *black leg*. Some years ago I had a number of calves that had the *black-leg*, and I took salt and poured turpentine on it, and let the calves have it. After the disease was a little more advanced, I drenched them with the same remedy, and I never had them to die when so treated.

"Dr. Paquin—As a preventive of *black-leg* they are now vaccinating in France.

"B. H. Hudson asked about chronic diarrhœa.

"Dr. Paquin said a good treatment for this complaint was rice water. Take about a pound of rice and boil it in a quart of water, and give a pint three times a day.

"Mr. Hudson said that he found toward the last stages, blood-shot mucous-membrane.

"Dr. Paquin—The true cause of this is rather hard to determine from your description. The rice water treatment is one of the best I know of, and has been accompanied with success; five drops of carbolic acid may also be given with it. It is also good for all kinds of young animals affected with any form of septic disease."

Mr. H.—Is it contagious? Some of them had a light cough.

Dr. Paquin—Did you ever open one and view the lungs?

Mr. H.—Yes, and found nothing the matter with the lungs, but found the bowels inflamed.

Dr. Paquin—The cough is due to sympathy. We often get cough with the *black-leg*. Rice water, with a few drops of carbolic acid, will prove a good remedy. Opium, 5 to 20 drops, according to age of animal, is good for diarrhœa.

Mr. Withers—Can you give a description of *Texas-fever?*

Dr. Paquin—General stiffness; arched back; feet near together nose dropped nearly to ground; a frequent cough; and a running of a coffee-colored urine. When opened, the spleen will always be affected and inside full of brown fluid, the spleen being three times its natural size. If it is known that the animals have been exposed to the disease, the first symptoms will be adequate. Dry-murrian is often mistaken for it.

"Mr. Roe gave his experience with Texas-fever. He had been buying cattle in Kansas City and taking them home to feed. In several instances Texas-fever had broken out amongst them. He turned them out into a field of green corn, and they got well at once. He had three steers to take it this summer, and one was so sick that its hide came off in spots. He got well on eating green corn."

Mr. Roe thought it was the weeds,—purslane perhaps,—eaten by the cattle while in the corn field that effected the cure.

Dr. Paquin had turned some ailing cattle into a field of green corn comparatively free from weeds, with good results; the bowels seemed to be loosened. He thought it was something in the green corn-stalk rather than the corn that did them good.

"Mr. Walker said that he had treated bloody murrain with poke-root. Just gave it raw.

"Mr. Hudson—What is the remedy for bloody warts?

"The Doctor said the best treatment was to cut them off and then burn with an iron heated to a white heat.

"Adjourned for supper."

EVENING SESSION.

"The announcement that the evening lectures would be illustrated by means of a magic lantern brought out a crowded house, a number of ladies being in attendance.

"At 8 o'clock the meeting was called to order by M. Fairchilds Doud, who introduced Prof. W. E. Coleman as the first speaker of the evening.

"He remarked that one of the speakers in the morning said it was strange that when you have a fair you call on some one else than a farmer to run it. 'But I don't think it any stranger than it is that I should take up your time to speak on a subject that I have not been identified with for twenty-five years. At that time this was a wild and sparsely-settled country; but look at it to day, teeming with a live and prosperous people. The question arises: Shall we go on, or do as they have done in Massachusetts where, owing to the want of a better and more advanced agriculture among the masses, the small farms have been bought up by capitalists and turned into dairy farms, and the former owners compelled to go to the cities and seek other fields of labor, or emigrate to a new country? I can speak of a county in your own State—Clay—that in the last census showed an increase in population of only thirteen. Why is this? Because when men of means come along and offer big prices for their land, they sell it, saying they can not afford to farm such high priced land. Prof. Sanborn proved this morning that this was untrue. The small farms thoroughly cultivated, pay better than large ones only half-tilled, as our forefathers were in the habit of doing. Not only would these small farms, well-tilled, yield more per acre, but a better quality of crops. We have established in our State, a college and experimental station, for the training of farm youths, and for learning them systematic farming; and as it is supported our agriculture must advance and the farmers of our State prosper. It is said we take no interest in farm matters. Looking over this audience to-night, I say it is an unjust charge, as this attendance speaks an awaking interest that is most gratifying.'

"Prof. J. W. Sanborn followed Mr. Coleman.

"He expressed his great pleasure in meeting such an audience. He was especially glad to see so many ladies, as he thought farmers should bring their wives to these meetings, and the brothers their sisters. They not only have to bear their full share of the trials on the farm, but don't enjoy as many of the conveniences to be had, as their fathers and brothers. The Professor then took up his lecture on plows and plowing, and by the means of a magic lantern showed the different kinds of plows used from the early days of civilization up to the present time. He said it was the first agricultural implement brought into exstence, and that we found it spoken of in Genesis. At that time man was a nomad, and wandered from place to place, in seeking for game, and pasture for his herds and flocks. The plow in those days was a crooked stick, or sticks crossed, and did little more than tickle the earth. But it was improved upon with the advance of civilization. 'We have pictured to us the highest type of civilization when the sword shall be beaten into plowshares. Coming down to the Roman Empire, we find the great Cincinnatus holding the plow, and being called from it to serve his country.' In coming down to later times, he spoke of our great Statesman, Thos. Jefferson, who, he said, while traveling in Europe in 1790, studied the plows he saw there, and was the means of having manufactured the first mechanical plow, the same year. He also spoke of General Putnam leaving his plow to take command of an army in the Revolutionary war.

"At this point he showed the pictures of plows for many periods, beginning three thousand years ago. The plow described by Virgil towards the close of the Roman Empire, was shown. It was something like our single shovel plow. Next were shown yokes for oxen, simple straight bars. A scene of treading out grain was given next. The *Rotherham* plow, a picture of which was shown, the Professor said was the first plow covered with sheet iron, and more like the plows now in use than anything shown.

"The first cast-iron plow that appeared in this country was made in 1797. It was invented in Scotland by Chas. Nebeau. He never got the farmers in this country to use it. Parliament sent a committee to investigate it. They said that it poisoned the earth and made the weeds grow. It broke Mr. Nebeau's heart and cost him $30,000. The plow that was used 45 years ago was invented by Daniel Webster. It was something like the plow now in use, but a little heavier. In regard to the plow in general, there is a good deal of art underlying the use of it. The question often asked, and an important one, is: 'What kind of a plow shall I use? I am a farmer on ground that is light and sandy.' Such soil is defective. Land with 100 parts of sand will absorb 100 parts of water, while heavier soil will absorb but 50.

"The kind of furrow to turn on this light sandy soil, is a flat one, as this soil needs compressing rather than opening. If your soil is not light, but heavy, then you need a convex plow, one that will break open the soil as much as possible; one that will form a furrow for drainage, and one for circulation of the air. If you will take some of the clay home and boil it, it forms kaoline on the surface. It is this that cements the land. Heavy land should be plowed when neither too wet nor too dry. Light soil should never be plowed in the fall, for it will disintegrate. On the other hand, heavy soil should be plowed in the fall, for yon want it to disintegrate. Frost is a powerful disintegrater. The ancients used to blast by means of it. I have found two plowings, one in the fall and one in the spring, beneficial.

"The normal draft of a horse is 300 pounds for a steady, all-day pull. That is, an effort equivalent to a 300 pound perpendicular pull. Sometimes when horses draw a ton on good roads the draft is only about 100 pounds perpendicular, whereas on bad roads it would be 400 pounds. This is a strong argument for good roads. The Professor said there was not one plow in twenty that was well managed. The line of draft should be from the horse's shoulder. 'When I was in Louisiana last winter I took occasion to visit one of the best plantations in the State. I found that the mules were so hitched up that each plow lost 100 pounds of force. I may travel around the field with you and find that your plow rises at the toe; if so, it has been adjusted wrong, or is worn at the heel. A plow that is rightly adjusted will swing free in the farmer's hands.'

"Dr. S. S. Laws followed Prof. Sanborn in a lecture on *Comparative Anatomy*, which he illustrated with a magic lantern and slides. He produced views of skeletons of animals, and of man. The gorilla, the bear and the man made the first group. He said the cuts were prepared for the use of artists and were true to life. The feet of the man and the feet of the bear were much more alike than those of the man and the gorilla. He next showed the skeleton of the man and the lion, and showed a striking resemblance in the construction of the limbs of the two. He said the maximum brain case of the gorilla was 35 inches, while that of the man was 120 inches. Strange to say, that of the woman was the same size as the man's. The speaker closed by quoting a statement of Waterhouse Hawkins, who said that while he had seen some success in converting a man into a monkey, he had yet to see a monkey turned into a man.

"Prof. Sanborn next took the magic lantern and showed the genealogy of the horse. He said: 'Professor Marsh tells us that the horse had for a long time but one toe. Here is a cut showing a foot with five toes. A horse that was seen in New Orleans and in New England some years ago by Prof. Marsh had eight toes.' Next was shown a horse of the cave dwellers, a short, small, rough fellow; also, pictures of the wild horse of Asia; the wild boar; the Egyptian hog; and the old hog of England, but little removed from the boar.

"Pictures of sheep and their improvements were next given. The Merinos came first; the sheep of the Indian Mountains next; the wild sheep of the Rocky Mountains, which has never been tamed, and th sheep of Iceland. The last had three horns, one of them running from the center of the head. Then there was the Cypress sheep, v four horns, and the fat tailed sheep of Persia. This was a very peculiar animal, its tail, the Professor said, growing sometimes to weigh seventy pounds, and in such cases a little wagon was yoked to the sheep, for it to haul its tail on.

"A cut of a grain of wheat magnified many times was shown and its construction described. Milk was treated in the same way, and its ingredients explained.

" It being now late, the meeting adjourned until 10 o'clock Wednesday."

WEDNESDAY MORNING'S SESSION

" Opened with a good attendance, notwithstanding it had snowed during the night and the air was raw and disagreeable.

"The Hon. J. O. Withers, of this county, was the first speaker. He said he had been farming in Saline county for over twenty years. 'We farmers in Saline county are not as attentive to our occupation as we should be. If we were, the results would be much more satisfactory. The fault is purely within ourselves. We have the best soil in the world; fortunately located in the great bend of the Missouri river, with an area of nearly 500,000 acres of well-watered and well-drained land, upon which can be grown to perfection almost all of the grains, all the grasses, all the field and garden vegetables and all the fruits; and yet the average of our two principal crops—wheat and corn—is not near so great as they should be. And why? I think the fault is as I said awhile ago—wholly with ourselves. I know that I am only a half farmer, and yet I have raised 75 to 100 bushels of corn to the acre for five successive years; and a neighbor, for the same years, on land equally as good, only averaged 40 to 45 bushels. I put him down as only a fourth farmer. I have raised over 50 bushels of wheat per acre, and the same can be done on many farms in Saline county. What we want, not only in this county but throughout the State of Missouri, is more thorough cultivation of our soil and more systematic methods adopted by the farmer.'

" Prof. Sanborn followed Mr. Withers upon the subject of stock-feeding and management. Stock-farming, he regarded as the corner-stone of our State's prosperity and wealth, and the raising and fattening of domestic animals as the basis of a high type of farming. They offered a home market for products, and returned to the soil the elements of plant growth, without which a profitable system of farming could not be kept up. Good pastures, barns, and food combinations that took in all the corn-fodder and straw of the State, were desirable. Pastures are the pivotal point of the most profitable system of farming. In them the greater part of the growth of our stock is made, and at a minimum cost. Two cents per pound will cover the cost of summer beef, while eight to ten cents per pound is required for winter beef. Indeed, winter fattening of cattle is not now desirable. Our pastures ought to carry a steer per acre. Indeed, English pastures carry more beef on mixed grasses, fifteen to twenty varieties of grass growing together each season of the year. This gives good grazing during all kinds of weather; drouth, wet or cold. Shade changes the chemistry of the plant, as has been shown. Dr. Sturtevant has shown that shade cuts down the yield of potatoes. A Frenchman has shown that a tree changes the electrical condition of the air. The mischief done by wood pastures was elaborated upon, and the speaker said that too many big weeds were allowed to grow in pastures. He insisted that a radical change was needed in the management of our pasture lands.

"The barn was next taken up, and a strong array of facts and experience was brought up to sustain an emphatic plea for better barns. The following figures were given, most of which were based upon personal trials. The professor asked criticism upon them as they were presented.

SAVINGS BY BARN TO COST $3,000 AND TO ACCOMMODATE 100 HEAD OF CATTLE AND HOGS.

1st.	4 lbs. of hay per day for 140 days at $6 per ton	$168 00
2d.	1.17 lbs. of corn per hog per day	82 00
3d.	Five hogs saved by shelter	30 00
4th.	Steer saved by shelter	30 00
5th.	28 tons of hay saved from bleaching rains and loss in stack at $6 per ton	168 00
6th.	20 per cent. of hay that is trod out under stacks	240 00
7th.	Earlier maturity of steer, $1 each	100 00
8th.	Chance to combine and use straw and corn-fodder of 16 acres each of corn, oats and wheat, to keep 20 steers more than could be by the present way	210 00
9th.	400 loads of manure at 50c. each	200 00
	Total	$1,228 00

CONTRA.

Extra cost of drawing hay to barn	$40 00
Extra cost of drawing out manure	100 00
Extra cost of saving corn	80 00
	$220 00
Net saving to credit on cost of barn	$1,018 00

"Food combinations had been experimented with, said the Professor, and ten years of special work in curing and handling straw and corn-fodder, and feeding it, had convinced him that corn-fodder and straw had a good feeding value when in the right condition, and that a great change in the process of stock-growing and management was needed.

"Adjourned for dinner."

AFTERNOON SESSION.

"The attendance was again good. The first speaker was Prof. Tracy, of the State University, who spoke on *Parasitic Fungi Injurious to Vegetation.* He gave an outline of the manner of growth and multiplication of the countless species of rusts, smuts and mildews which were abundant upon almost every kind of cultivated plant. These rusts and smuts were not diseases of the plant, but were true parasitic plants, as distinct and constant in their form and growth as are the plants upon which they feed. We have always been familiar with these parasites, but still have very little definite knowledge regarding them, on account of their exceedingly minute size, and the impossibility of studying them without the aid of a microscope. The smallest plants known are the *bacteria*; plants so small that a hundred or more of them might form in line across the edge of a sheet of paper and still not be crowded. Although so small, they are infinitely more abundant than are the larger plants which we know more perfectly. They are found wherever there is moisture, and are the cause of fermentation, decay, and also of many of our contagious diseases. Tyndall demonstrated that meats, fish, soup and other similar substances might be kept almost indefinitely without spoiling, if the *spores* of these plants could be excluded, although the air might have free access. He found that air filtered through a thickness of cotton batting, was entirely free from these spores. Acting upon this hint, Mrs. Kidzie, of the Kansas Agricultural College, last year put up several varieties of fruits prepared as for canning, and instead of sealing the jars, she simply tied a thickness of cotton batting over the tops of the jars, and the fruit was preserved perfectly.

"Mr. Arthur, of the New York Experiment Station, had demonstrated that *pear-blight* is simply the effect of the presence in the tree, of these minute parasites.

"The growth and multiplication of wheat-rust, corn smut and other fungi were traced, and specimens of many species were shown to the audience.

"We are now learning the life history of these plants, and until this is known, we can not work intelligently in devising remedies or preventives. Several of the State Colleges, notably those of Illinois, Missouri and Michigan, are now devoting considerable attention to these plant parasites, and Commissioner Colman has appointed Mr. Scribner, an indefatigable worker in this line, to a position where he can devote his entire time to the work, so that in the near future we may hope to know, not only how these minute plant parasites live and grow, but what we must do to prevent their ravages."

The next speaker was Mr. J. A. Potts, of Mexico, Mo., a member of the Board of Agriculture, who spoke upon

THE HORSE.

By J. A. Potts, Esq.

Mr. President and Gentlemen:

I have been assigned the duty of giving you a talk upon the horse; which I will proceed to do, to the best of my ability.

This noble animal—in my humble opinion—does not receive the attention from us as a Nation, or from us as a State, or from you, gentlemen, as a county, that he merits, or that his importance demands. Nor do we hold him in as high esteem or appreciation as we should; for he is, and has ever been, the most valuable servant given to man. He is the grandest servant of all the world, and does his duty nobly wherever he is found; whether in the far East, drawing heavy loads of merchandise; or on the western plains, galloping under saddle and spur after the vast herds—his service is alike indispensable.

Not only in the East and West, is he found; but in every part of the two vast continents settled by civilized man, he is present, adding to his master's wealth, comfort and pleasure.

There are horses suited to all our demands; the heavy draft, such as is used to draw great loads at a slow gait; the coach, which has more style and action, with less bone and weight, and a very valuable animal in many respects; the trotter; the saddler; and the thoroughbreds. All these have important places to fill, so much so that neither can well take the place of the other.

In large cities, the draft horse is very important; and wherever large loads are drawn at a slow pace, his service is almost indispensible. This horse is often reduced in size by crossing with smaller stock, which produces an animal thought by many to be valuable to the farmer. I will admit that this cross can draw a plow or a wagon equally as well as most animals; but the mule can perform the same duty, with equal success.

The question that should receive our deliberation, is the foundation we are laying to perpetuate our horse stock. In the cross-breeding, an animal has been produced that cannot be used with any degree of certainty or satisfaction, either as a brood mare or in the stud; for he is as liable to breed after his dam as sire, which places the farmer or horse breeder that has such foundation to work from, in an awkward position.

Here let me state, that I positively believe that cross-breeding works more evil to our horse interests than any other one thing the farmers and horse raisers are guilty of.

I am a firm advocate of line breeding; that is, if you have a draft-mare, and breed her at all, breed her to a draft horse; a harness mare to a harness horse; a coach mare to a coach horse; a saddle mare to a saddle horse; and a thoroughbred mare to a thoroughbred horse. You then know just what you will produce, and will not have to experiment with your horse until he is six or seven years of age to find out what he is fit for. If you do not follow line breeding, you may work with your horse for years to find what he is best suited for; and nine times out of ten, if you try him thoroughly, you will find he is fit for nothing, or no particular business.

This thing of raising and breeding horses is not a game of chance. Its rules are inevitable, and they can be demonstrated similarly to a mathematical calculation. Certain causes produce certain effects in this branch of industry, as in any other; and these causes may be investigated. I ask you gentlemen: Is there any business, however plain and simple it may appear, that a man can engage in and make a success of, without study and attention?

This is not an exception to the rule; yet, with a moderate amount of study and attention, this business can be made one of the most lucrative in the land.

Some men who have been studying this business, and pursuing it in line breeding for but a few years, are making princely fortunes. I saw a few days ago a statement in the "*Spirit of the Times*," under date of November 14, in regard to the sale of about 335 thoroughbred yearlings that had been sold in the United States during the past season, at public auction. They were the get of sixty eight different sires, and brought an average of $580.70 per colt. Where, gentlemen, is there a business that will pay better, even at one half or one third that amount? I also saw where a lot of trotters were sold, which brought from $800 to $1,500—they being from two to three years of age. What better than this would you ask for? This is line breeding; and if it is adhered to closely, by selecting good individuals in one line, it is sure to lead to success.

I would suggest to every man who contemplates raising a colt, that it would be at least prudent to select a sire of the same class as the dam; and to be sure to get a sire worthy of his class. Examine him closely, as a good and prudent engineer would his engine. See that he has no weak points. Examine his eyes, feet, limbs, wind and loins. In short, look him over from head to tail, and if you find no weak points you can next examine his form. If you then find his head, neck, shoulders, back, ribs, loins and hips symetrical, and backed up with good strong muscles, you may engage his services without fear of regret, even if you have to pay for them what may seem a little high at the time.

I insist very much upon soundness in animals. No animal should be allowed to contest for a prize in any ring (unless for speed alone), without being sound. We are certain to get unsound animals enough without breeding for them.

How many of you, gentlemen, would buy a new wagon, a new reaper, or plow if you saw that a wheel, or a sickle-bar, or a beam was defective; or even a chain with some of its links defective? Every man of you would reject such stuff at once. How much more reason is there in rejecting a horse that is weak in places, or unsound, if you expect to use him as a breeder; he being liable, not only liable but almost certain, to hand this weakness or unsoundness down to his posterity. In the wagon, machine, plow or chain you may replace the weak and defective parts with duplicates, new and strong. But the horse is no stronger than his weakest point; though this is not the serious point, as I look upon it. It is the certainty by which he transmits this same weakness to his progeny. We, one and all, should give this serious thought.

I would recommend that the Legislature pass a law requiring every horse to be examined by a competent veterinarian before he is allowed to be put in the stud. After examining him, if he be found suitable, grant him license; and make it a finable offense to take service fees for a horse without license.

It is the desire of every farmer of this State to use his resources to the best possible advantage; for us to be able to do so, we must know our own advantages, and our neighbors, and then compare them. The time is not far in the past when our broad prairies furnished free grass a good portion of the year. That day has passed. We could then make beef for one-half its cost to-day.

The West with its cheap grass has wrenched this industry from us, and it is weakness for us to cling to it, like a dying man to a straw. The horse they have not taken from us, neither can they; because the horse does not develop and acquire that beauty of form, style and action under such treatment as he is subject to in the West, which he does here, where he can have the nutritious blue and tame grasses to feed upon the greater portion of the year, combined with good protection from the winter's storms, with some grain in colthood added. The starving and freezing process degenerates the horse year by year, and they who work under that rule are as sure to fail, as time to continue. It matters not how valuable a colt may be, if he is not cared for and protected he will bring no profit. We should aim to get all the good qualities possible in a colt; and then to nurture, foster and protect them. I do not mean by that, to put it in a close stable, and feed it like a pig; I mean, that it should be kept growing and developing the year round; have exercise, pure air, pure water, and plenty of it; and protection from the storms of winter.

I have said that we as a State, do not pay the attention to the horse we should. How does our State stand to-day? We may go into the great markets of our nation, and the tale is there told in a few words. You ask: "Where do these fine, fat steers come from; or these fine sheep, or hogs?" They attract your attention, because they are a credit to any country. You are liable to be truthfully told, "From Missouri," by a man filled with pride and animation. You step down to the horse market. What then do you see? You ask: "Where did this fine draft team come from?" You are liable to be answered, with the same pride and animation, "From Illinois." You still look around and see a nice coach team. They are beauties, every inch of them. Every move, every action as graceful as a fawn's, and yet large and strong enough to draw three thousand. You ask: "Gentlemen, where was this team raised?" You will receive the same truthful answer, "In Iowa," or Kentucky; some of our sister States. You still look around and find a horse of fine size, style and action, that can draw a road wagon at a 2:40 gait, one whose very eyes sparkle with spirit. One that would make an aged man feel like a youth again to draw the reins over. You ask where he came from. You will receive the same answer as above.

You still pass along and see a large horse with small bone, or a small horse with large bone, or a medium sized horse with short neck and dull eyes, or probably with one eye out, and you ask where this stock came from. You may have to ask twice before you receive an answer, which, if truthfully given, will be with a blush: "From Missouri."

This state of facts is caused by cross breeding, to a great extent. Breeding with no particular end in view, only to raise a colt. In regard to the standard of our horse, we are behind our sister States. I am very sorry to say it is a fact which there is no use of trying to deny. Nature never put us here. Nature has smiled upon us, and placed us second to none in this grand Republic. She has given us climate, water, grass and soil suited to the development of this animal; and if we will but use the means placed in our hands, we can, in a few short years have the Missouri horse sought after in every market of the United States, from Maine to California.

"Mr. Potts' remarks were well received and generally discussed.

"Mr. A. B. Mathews, of Kansas City, said in reference to cross-breeding referred to by Mr. Potts, 'If the gentleman means that we are to breed our scrub horses to scrubs, then I do not agree with him; neither do I believe that the little mare should be bred to the little horse. Another thing: I believe the best beef animal on earth is an animal from a thoroughbred Short-horn cow bred to a black polled bull, and yet this is cross-breeding; but I am satisfied it is so.'

"Mr. Mahard—I think there are very few thoroughbred stallions in our county; our mares are nearly all cross-bred, coming from the Mexican mare bred to the draft, trotting or running horse. The policy with us should be to breed to the horse that will produce the best all-purpose animal for the farmer.

"Adjourned for supper."

EVENING SESSION.

"At 8 o'clock the closing session of the Institute was opened. Dr. S. S. Laws, President of the State University, was the first speaker introduced. He read a lengthy and very interesting paper on '*Pasteur and His Discoveries.*'

[This valuable paper will be published in the next annual report of the Board of Agriculture.]

" Dr. Laws was followed by M. Fairchilds Doud, of the Board of Agriculture, who spoke of the coming farmer, and compared his condition now with that of ten years hence. He drew a vivid picture of his advancement, and of the benefits that must accrue to the farm interest from the closer study, experiments and investigations that are being made into agricultural matters.

" This closed the Institute and one of the most successful meetings ever held in the State."

THE KANSAS CITY FAT-STOCK SHOW.

The following paper was prepared by Col. Ed. Haren, late Secretary of the Kansas City Fat Stock Show, to be read before the Farmers' Institute, at Marshall, Mo.:

I am here, gentlemen, in the interest of an institution in which you are all interested, *i. e.*, the Kansas City Fat-Stock Show, and to urge upon you the importance of encouraging, by every means in your power, an enterprise which is calculated more than any other to stimulate the improvement in the breeding and feeding of cattle, sheep and hogs, and to add much to the value of the live stock interests of Missouri.

The Kansas City Fat Stock Show was inaugurated three years ago, by a few public spirited gentlemen interested in the live-stock trade. Though their interests in live-stock were scattered from Canada to Texas, they cheerfully contributed the amount of money necessary to make the experiment of the first Show at Kansas City. They had watched for five years the progress of the Chicago Fat Stock Show, and studying its effects, they believed that a similar show held at Kansas City, the natural point of intercourse between the breeder of fine stock in the older States and the range men of the "New West," would do much to induce our friends on the range to improve their beef animals, and the feeders which are so necessary to our corn-producing States. Results have proven that in this they were not mistaken.

The first Show was a success, beyond the expectation of its most sanguine friends and promoters. With commendable liberality they donated the amount left over at the close of the show, some $400, towards the establishment of a permanent show. Upon this foundation the existing Kansas City Fat-Stock Show Association was formed. It was found that the amount necessary to conduct an annual show was about $7,000. This amount included the payment of premiums, publishing premium lists, advertising the show, Secretary's salary, labor during the show, and other necessary expenses. Until the people could be educated to take a more lively interest in a matter that concerns them so directly as the production of "better meat," and to contribute to its encouragement by their attendance at the Show, it could not be expected that the admission fees charged would cover the expenses. For that reason the capital stock of the permanent organization, formed after the close of the first Show, was fixed at $20,000, of 200 shares at $100 each, and payable in four annual installments of 25 per cent. This would give the Association a fund of $5,000 annually for a period of four years; not enough to cover all the expenses, but the deficit, it was believed, could be easily raised by donations from Kansas City business men, who would naturally be benefitted by the annual gathering of such good customers as the live-stock men of the West.

The 200 shares were to be distributed among the breeders, feeders, range men, and others directly interested in the live-stock trade. Of the shares so taken, not a dozen, I believe, have been placed outside the classes named. The object of this was to keep the control in the hands of men interested in the fulfillment of its legitimate mission, and that it might not be diverted at any time into a mere money-making scheme, or used to boom any particular interest.

I am sorry to say that while enthusiastic over the first Show and anxious that the Show should be made permanent, the classes named, who were expected to take hold of the organization, did not respond very promptly or liberally. When the time came for the managers to determine upon the second show, they found less than 100 shares subscribed. With great nerve, and with only $2,500 of the necessary fund of $7,000 in sight, they decided to go ahead and have a show, trusting that the contributions of the railroads centering at Kansas City, and the business men of that city, and increased gate fees, would carry them through. They received liberal contributions from the railroad and business interests, but the gate fees did not increase enough to help them "out of the woods." At the end of the show a deficit was found of $1,800. Not a very encouraging prospect for a permanent show. The friends of the enterprise, however, were loth to give it up, and renewed efforts were made for the third annual Show. By dint of hard begging, some additional subscriptions to the stock were obtained, and again the business men of Kansas City and the railroads contributed liberally. The result is, that the recent show, like its predecessors, was a successful show. It did more, however; it paid up the debt of the previous year, and the Association now has a balance of some $500 in the treasury. This was due, though, to extraordinary effort on the part of a few energetic and enthusiastic friends of the enterprise, prominent among whom were Mr. Richardson, the Treasurer; Mr. Epperson, of the Executive Committee; and Messrs. Chas. Gudgell, of Independence, and H. C. Duncan, of Clinton county. These parties cannot be expected, however, to give their time and influence year after year to the cause, unless the breeders, feeders and others interested in the results of a fat-stock show come forward and subscribe the remaining 59 shares.

This should be done, and done at once, to insure the permanence of an enterprise the benefits of which, to every one interested in live-stock, cannot be questioned.

The shares all taken and the assessments promptly paid, thus placing in the hands of the directors a guarantee of good faith, I venture to predict for the future of the Kansas City Fat-Stock Show, a series of glorious successes, and a proud position among the live-stock expositions of the world.

MEETING OF THE BOARD AT PALMYRA.*

The Farmer's Institute held at Palmyra December 22d and 23d under the auspices of the State Board of Agriculture was well attended, and a success. The speakers present were Prof. J. W. Sanborn, of the State Agricultural College; Dr. Paul Paquin, State Veterinarian; and Prof. L. R. Taft, of the State Agricultural College. Mr. J. R. Rippey, member of the Board of Agriculture, was to have been present, but was detained by sickness in his family.

THE MORNING SESSION

was opened by Secretary Sanborn, of the State Board of Agriculture, with explanatory statements of the purposes of the Board, and its work in the interest of higher intelligence on the farm and in aid of higher and more profitable farming. He spoke of its functions in collecting crop reports; whereby the farmer gets, by an organization in his interest, the outcome of the season's crops, acquires information as accurate as speculators can obtain, and is afforded a means of estimating the probable demand, thus being removed from the position of a ready victim to buyers of farm produce, who were heretofore earlier informed.

The speaker then proceeded to discuss the elements essential to the elevation of farm life, and to better and more profitable farming—much as at the Marshall Institute, He asserted that this question was ever uppermost with him, and insisted upon a radical departure from our present system of farming. And he was glad to see that a better

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*From *Kansas City Live Stock Record.*

method was being desired by farmers, who are beginning to realize its importance and are casting about for a new pathway. This era, the speaker said, was the first in which science had offered its guidance to the farmer, and whatever the first reception of it by farmers may be, there can be no shadow of doubt, but that the time is coming when farmers will seek all information that science and experience may offer. If these facts are complex and abundant, there can be no doubt that their organization will call for settle study like other callings, and that the school for the farm is a settled fact, to receive a more general and public recognition each year.

The speaker went on to say that we measure the social position of industries by the amount of intelligence that is applied to them. On this basis, as farming is founded on more of the sciences, or upon a wider reach of principles than any other profession or art, it is inevitable in its intellectual development that it should rise on the plane of social consequence, of knowledge and of the prolific sciences that bear upon agriculture, and that young men will become fonder of, and more wedded to the farm. The increased companionship with nature given by a knowledge of the laws of nature which surround the farmer in a profusion known to no other class, and a taste for literature that always comes from mental activity, must give a companionship on the farm that was impossible under the old order of things. And this increased developement of social life on the farm must make farm life more attractive. With the improvement of our country roads and the development of urbane life, a new intellectual life must open up before us, which will break down the barriers that have made so distinct a division between city and country, and the country will then have the greater attraction of the two.

AFTERNOON SESSION.

After a few opening remarks by Secretary Sanborn in further elucidation of the morning discussion of "How to Farm Profitably," Dr. Paul Paquin, State Veterinarian, was introduced, and spoke upon animal diseases.

In reply to the question: "How can we tell bots from colic?"

The doctor said: "Bots enter the horse as eggs, exist as larvæ in the horse, and find in the stomach their natural home. Here being their place, they are seldom destructive. I have never seen a death from them. Everything of the colic order or that can have the appearance of stomach trouble, is wrongly laid to bots. As their heads are in the lining of the stomach, to which they cling tenaciously, it is difficult to dislodge them. They do not cause death unless they get through the stomach."

Distemper was next touched upon. The speaker said it would run its course and needs little treatment. Good air, dry quarters, healthy food and bran mashes would help its disappearance.

In treating wounds from barbed-wire fences the doctor said: "They vary too much for a general answer. They bleed less than clean cuts. Veins will not bleed profusely. If an artery is cut, heat an iron to white heat and sear the edges, or better, twist a rope around it with a stick, or put a bandage or wadding with flour sprinkled over it, around the wound. The latter is not needed if the first remedy stops the bleeding."

The next question was: "Will watering a horse before and after dinner prove injurious?"

Dr. Paquin said it would, and added: "Cold water stops digestion, and the stomach will become active again only when the food is warmed up to blood heat. Give the water, if practical, in a small amount when the horse comes in, let him stand awhile, and then give him more, and then feed. And after feed, give a little water. The stomach holds but about 12 to 14 quarts, and if much water is given after feeding grain, the oats are driven out into the intestines."

Hog cholera was next discussed, the same as at the Marshall Meeting. He believed in the "germ theory" and spoke of vaccination as a preventive, saying that Pasteur, the great French chemist, has been quite successful in this mode of treatment. But the safest and best way, the doctor thought, was to kill all diseased ones, and disinfect thouroughly everything where the disease has been.

Prof. L. R. Taft next took up horticulture, and spoke on orchards. In answering the question, "Will old or new ashes be best?" he said whole ashes were worth double bleached ashes.

As to the depth of planting trees, he said he would put them in with roots covered four inches deep.

The last two winters, the speaker said, had worked sad havoc among the orchards of the West and Northwest; but this is owing in part to the improper selection of location and soil.

To produce the best results the soil should be well drained, high in location, and only moderately rich.

In planting an orchard, is is best to use trees one or two years from the bud or graft, as these are less costly, are easiest handled and planted, and are more likely to live than large trees, while they will bear just as soon.

Take pains to work the soil carefully among the roots, and press it firmly with the feet.

For the first few years the trees should be mulched with straw or hay, to prevent the baking of the soil and the evaporation of the water.

It has been found that trees are longest lived when kept in sod. When the soil is cultivated, the trees, especially in a rich soil, will often make a rank growth of three or four feet. The wood will be soft, and as it generally fails to ripen, the growth will be killed during the winter. In clean, open soil too, the freezing and thawing of winter is more injurious than if the ground is covered with a good sod. The best rule is to consult the appearance of the tree, and if the growth is too rank throw the land into grass, and keep it in sod so long as it makes a good growth.

Whenever the trees needs stimulating, it is best to spread on twenty or thirty loads of thoroughly decomposed manure, or one hundred bushels of unleached wood ashes per acre.

When it is impossible to do this, plow up the land and cultivate it for a year or two.

The trees can be protected from field mice by banking them up for a foot or so with soil, and borers and rabbits can be kept away by wrapping the trunks for a foot above this with tarred paper.

For erect growing trees the head should be formed at about three feet from the ground; but spreading trees should have the head five feet high. A tree with a low head is less likely to be broken down by the wind, and the branches will then be able to keep off the scorching rays of the sun from the truuks.

When the tree is planted, the branches should be cut back to form a regular shaped head; and if they are pinched back so as to keep the the tree symmetrical, and only such branches are allowed to grow as are needed, there will be no necessity of murdering the tree in after years, with the saw.

Pick the fruit by hand, assort it into three grades, and pack closely in clean barrels.

From the time the trees get into bearing, it is advisable to use the orchard as a hog pasture. These animals will eat the fruit that drops from the trees, and thus help to keep down the insects, and will also induce the fruitfulness and growth of the trees.

As to what kind of grass to sow in an orchard, he said he preferred timothy, as it was less exhaustive than clover.

Judge Turner—I have the second largest orchard in the county, and I can not agree with the speaker in renovation of orchards. After ten years of age it does not pay to renovate them. When I quit tilling orchards, I quit harvesting them.

In reply to the question: "Is Paris green a safe remedy for *plum curculio?*" Prof. Taft said *no.* Pyrethrum is useful and best. Paris green is used for spraying from a wagon as we drive shrough the orchard.

As to the culture of orchards with fertilization, the Prof. said he would still want a sod—and even close to the tree. It was asked: "Will it do to dig a sod around close to a tree when it is growing?" The Professor thought it would.

An auditor—My orchard grows very rank, reaching three feet growth in the branches.

Prof. Taft—I should think you would have some trouble by winter-killing.

Auditor—I do. Does curculio attack the plum in the flower?

Prof. Taft—Qes, when going out of a flower.

Auditor—Would you use Paris green for the curculio?

Prof. Taft—No, but would use pyrethrum, or shake the tree every morning and gather up the insects for a fortnight.

Auditor—What stock is hardiest—buds or grafts?

Prof. Taft—There is no difference in the value of the tree—yet the grafts work easier.

Auditor—Do you believe in scraping trees?

Prof. Taft—I would loosely scrape the tree to wash it, to destroy insects.

Auditor—How would you stop the borer?

Prof. Taft—Use a tarred paper of a foot width around the base.

Mr. Chubbuck—Is there not a patent on tarred paper?

Prof. Taft—I have known of its use for fifteen years.

EVENING SESSION.

Prof. Taft was the first speaker, taking for his subject small fruits, on which he said:

Every farmer in the State should devote a small piece of ground to the growth of small fruits for his own use, and in these days when the ordinary operations of the farmer are exposed to loss from the effects of the weather, or the attacks of insects or disease, he can find no surer money crop than the growing of small fruits for market. For this purpose any open, well-drained soil can be used.

Whether for home use or market, the Crescent seedling, Capt. Jack and Cumberland Triumph are the most profitable strawberries. Wilson is valuable for shipment, and Chas. Downing would be, perhaps, best of all were it not liable to attack by rust. Whether planted in April, August or October, the soil should be constantly stirred during the first season. Mulching should be applied as soon as the ground freezes. This will prevent injury by freezing and thawing in the winter. Keep the berries clear, and check the evaporation of water from the soil. Great attention should be given to the picking; as green berries, stems and leaves in the boxes will lessen the price.

Raspberries and blackberries require about the same care as strawberries.

The best red raspberries in Missouri are Turner and Thwack; Marlboro promises well. The best black caps are Hopkins and Sonhegan for early, and Gregg for late.

The only blackberries that succeed are Snyder, Taylor's Prolific and Western Triumph.

The application of ashes, ground bone and decomposed manure has become necessary for a good crop of fruit, and for the healthy development of the plants.

Prof. Sanborn followed Prof. Taft in an illustrated talk on the plow and plowing, with cuts of many ancient agricultural processes.

In addition to the remarks made on this subject at Marshall, the speaker considered several new points in his talk. In the hanging of a plow he said that few plows were correctly handled. The line of draft, the speaker said, was from the center of resistance on the plow, and should always strike the bridle without a tendency to either elevate or depress the plow beam, as this caused the plow to draw harder and to do poorer work; a plow in the hands of any but a skillful workman will draw easier with a little wheel or truck under the end of the beam.

The adjustment of the coulter is also a delicate matter, as increased draft will follow an improper adjustment. The speaker said he had been experimenting in these directions and would give the exact results to the public, soon. He also found that a plow would draw a depth to which it is fitted, to better advantage than any other depth; hence in purchasing plows, those should be sought adapted to the depth we choose to plow. The depth of plowing must be always governed by the character of our soil. A light, open soil, non-retentive of water, a soil that is thin, or having but little agricultural soil, should be plowed shallow. Soils, also, that have long been plowed shallow, or whose sub-soil is acid, must be plowed deeper, very slowly or half an inch deeper yearly. On good soil, drained if needing drainage, and whose under-soil is open enough to the air to be sweet, he would plow seven to eight inches deep. As the roots of plants are near the surface, it is seldom desirable to plow deeper than the soil can be made rich. In laying out ground for plowing, to have good furrows, the speaker divided the ground into three sections, and advised plowing the two outside sections first, and then the center section; by this means but one level furrow is made.

MEETING OF THE BOARD AT LEWISTON.*

The third of the series of Missouri Farmer's meeting, was held in Lewiston, Lewis county, Mo., beginning with a night session, Dec. 23rd. The meeting was held in Grange Hall, and was called to order by Prof. J. W. Sanborn, who described how the State Board of Agriculture was constituted, why it was created, what its work was, and the purpose in view when the meetings were inaugurated.

Mr. J. H. La Rue, of La Belle, was chosen chairman. He thanked the audience for choosing him. He was only a plain, practical farmer, not one of the "kid-glove" sort. He said he had done his part to have a good meeting, but was disappointed at the small number present.

[Prof. L. R. Taft who was the first on the programme, discussed small fruits, much as at the Palmyra meeting. See page 291] His talk called out a good many questions.

Ques.—What is the best time to prune blackberries?

Ans.—Any time from now on.

Ques.—When should we remove the canes?

Ans.—Immediately after they are done bearing.

Ques.—Is it necessary in renewing a strawberry bed, to plant on new land, or will it do to plant on the old bed?

Ans.—It is best to plant on new land.

Ques.—Some claim that the foliage should be picked off of grape vines to hasten and improve the ripening of the fruit. Is this right?

Ans.—It will hasten the ripening, but hurt the vines and injure the quality of the grape.

Ques.—How can we grow English gooseberries?

Ans.—It is almost impossible to grow them in this climate. It must be cool and moist for both gooseberries and currants. On the north side of a tight fence is a good place.

Ques.—Will sulphur kill rust?

From "*Colman's Rural World.*"

Ans.—When on the surface it will, but when in the tissue of the plant it is not effective.

Ques.—Does it make any difference whether the planting is done in the light or the dark of the moon?

Ans.—I don't take any stock in " moon " theories.

Some in the audience were not sure, but that the moon had much influence on vegetation and other matters of the earth, while others, in view of the fact that many believers in " moon-shine " held just opposite views as to the effect, did not believe in it.

Prof. Sanborn then occupied the attention of the audience with some interesting remarks on plows and plowing, following which he showed, with the aid of a lantern, cuts of plows of the most ancient type and those of more improved pattern.

He showed that as the world had advanced in civilization the plows had improved, so that the world's progress was marked by improvement in plows. Following the evolution of the plow down to the present time, it was found that only a few years back of the present time, plows were in use which would now seem very ancient. There were men in the audience who had plowed with wooden moldboard plows.

Among the pictures projected upon the screen, were some reprerenting harvest scenes of two thousand years ago, and in them was seen the reaping hook, which was essentially the same tool that was in use within the memory of most of those present.

In one scene, grain was being trodden into the ground by driving flocks of sheep and goats over the freshly sown field.

Mr. La Rue said he had seen grain covered in the same way in California.

These facts show how rapid has been the progress of agriculture in the last fifty years. Many do not realize what wonderful progress has been made in this direction, and such are in danger of being left behind in the onward march of civilization.

A knowledge of what has been done in the past enable us to appreciate our conditions, and stimulates us to press on and take a proper place in the world.

The lecture and the illustrations were much appreciated by the audience.

At the beginning of the morning session of Dec. 29th, Prof. Sanborn made a few remarks concerning the benefit to be derived by farmers from agricultural papers, and said as good advice as he could give to farmers would be to take some good paper. Papers, he said, were the college of the masses.

He then went on to speak of the objects he had in view in his work as Secretary of the State Board of Agriculture, and through his connection with the State Agricultural College.

Man was the highest object of creation and the intellectual past was superior to the physical; hence those industries that called for the largest amount of intelligence were respected and looked up to. There was a time when there was a land aristocracy, now it is the aristocracy of the intellect. Many of our grandest ideas and improvements have been built upon the natural sciences, and so must agriculture, as this is dependent on them. The farm opens up the grandest opportunities for the development of the intellect. The farmer is surrounded by animate nature, and the life he leads is favorable for the development of the moral, physical and mental natures. All the sciences needed by the scholar are needed by the farmer. When fully developed, this calling gives the most rounded and complete manhood.

There are now probably two thousand men engaged in studying the science of agriculture, and trying to find out the underlying laws.

We are now more especially engaged in the development of the economic welfare of farmers.

Said the Speaker: " I see before me men who are capable of three times as much mental effort as they are using in their business, and the farms of the State are not producing one-fourth as much as they are capable of doing. 11.8 bushels of wheat per acre, 26 of corn, 27 of oats, and a little over one ton of hay, what the State is now producing, is far short of what can be grown. These figures do not represent $1.00 per day for the farmer, for labor expended.

" We have been improving our machinery until we have the best in the world, but have not improved our methods of farming. We now have no system, and must adopt one which will upbuild rather than tear down our land.

" To bring about this end there should be adopted " a wise system of rotation of crops, suited to the conditions of the farm. Among the many reasons given for adopting rotations of crop, the following were among the most obvious: Different plants require of the plant-food existing in the soil, different proportions. Different plants feed in different areas of the soil, some deep and some shallow; thus if the crops are varied, the soil is less rapidly exhausted. Maturing at different times, a variety of crops distributes the farm labor more evenly through the year, and hence better culture can be given to the crop. Better crops, and a greater variety, and a larger quantity of food can be grown, which will allow more stock to be kept, from which more manure can be made with which to enrich the land.

"Plenty of manure is the sheet anchor of success in farming, and to get this we must feed our straw and corn fodder. When properly saved and fed, these have a feeding value but little less than that of hay."

Prof. L. R. Taft gave a talk on orcharding. [For the substance of his talk see page 289.]

After the paper was read, it was asked if axle grease was good to keep borers out of apple trees.

Ans.—It may be good, but I don't like any oil about a tree.

Ques.—Is it true, as claimed by some agents, that root-grafted trees do not form a tap root?

Ans.—Yes, although in digging seedlings the tap root is usually cut, and none is afterwards formed.

Ques.—Would you, in setting out apple trees, incline them to the southwest to protect the trunks from the sun?

Ans.—No, as they would then be more exposed to the north winds. It is better to protect the trunks from the sun by boards nailed together forming a V shaped trough.

The meeting was now adjourned to meet after dinner in the church. A series of meetings were in progress in the church, but they were kindly suspendeded for the afternoon, so that the closing session of the Farmers' Meeting could be held there, as the Grange Hall was not large enough to accommodate all who wished to attend.

When the audience was assembled for the afternoon session, Prof. Sanborn made some remarks on stock feeding. He showed how important this branch of agriculture was, both to the world as a source of food supply, and also as a means of consumption of the products of the farm and returning to it a supply of fertilizing material. The importance of shelter for stock was dwelt upon, and the speaker showed that money invested in barns would pay a good interest, in food saved and increased gain. Hay and corn-fodder sheltered from the weather were worth more than when exposed.

Stock-feeding in all its details is a most complex science, yet the fundamental principles are such that anyone of ordinary intelligence can understand and apply them.

Dr. Paquin, the State Veterinarian, was introduced. He explained his official position, and then proceeded to speak of some of the prevailing diseases among domestic animals.

He described hog cholera, among others. [For the substance of the Doctor's talk on this subject, see page 215].

Other diseases were spoken of, and many questions asked that drew out many important points.

Judge Anderson of Canton, Mo., was called upon to address the meeting, and with some reluctance consented. Though a lawyer, he had some experience at farming. He did not claim to be as good a farmer as Dr. Sanborn. "Mister, not Doctor," interrupted Prof. S. "Excuse me," said the Judge, "'professor' had become rather monotonous around here, so I thought I would say 'doctor.'" Continuing his remarks, while he did not rank himself as a farmer as high as Prof. S., yet he somewhat doubted the ability of the Professor to obtain the crops indicated by his figures. "Yet seriously," he said, "all that the Professor has said is true, and the time has come when we must have a careful and a better system of farming here in Lewis county." The Judge continued his remarks in a pleasant way, much to the pleasure of the audience, and in relating some personal experience, declared in response to a question, that the family relation was the foundation of all successful farming.

MEETING OF THE BOARD AT DE SOTO.

De Soto, December 29th, 1885.

Met at 10 A. M.

President Eshbaugh in the chair.

Speakers present:

G. E. Morrow, Prof. of Agriculture, University of Illinois;

Judge Thomas of De Soto;

Hon. H. Eshbaugh;

J. W. Sanborn, Prof. of Agriculture, University of Missouri;

L. R. Taft, Prof. of Horticulture, University of Missouri;

Dr. Paul Paquin, State Veterinarian.

The Board was welcomed in an appropriate speech by Judge Thomas of De Soto.

President Eshbaugh opened the meeting by a general talk on the work of the Board.

The first speaker introduced was Prof. L. R. Taft, who spoke on orcharding. The substance of his address will be found on pages 289 to 291.

Quite a discussion followed this address.

Mr. Heiney—What is the cause of bitter rot?

Prof. Taft—Too much water about the roots may be the cause. In such case, drainage would be a remedy. Gad fly may often be the cause of this trouble. Mineral manures often remedy or prevent the trouble.

Mr. Heiney—I have heard that a piece of iron driven into the tree would effect a cure.

Prof. Taft—Keep out nails, and apply copperas, guano or ashes.

Mr. Heiney—How much ashes?

Prof. Taft—One peck to two bushels.

Ques.—How deep and how far apart should young trees be planted?

Prof. Taft—That depends upon the soil; but generally a foot deep and ten feet apart.

Ques.—When is the best time to plant?

Prof. Taft—That will depend upon the character of the soil; whether wet or dry. If the soil be wet, it is best to plant in the spring. It is a good plan to heel in, in the fall, and get roots calloused over, and plant in spring.

Ques.—When should the tree be washed for borers?

Prof. Taft—In May; use soap or lye.

Ques.—What proportion of Paris green should be used for the leaves of trees, to destroy insects?

Prof. Taft—One teaspoonful per gallon of water, less for peaches.

Mr. Eshbaugh—How would you make cabbage *head* when backward about heading? I was told by an old lady to use salt in such cases.

Prof. Taft—I found salt good.

Adjourned to 1 P. M.

AFTERNOON SESSION.

The Secretary opened the meeting by a talk—*The Changes Now Demanded in Our Farming.*

Prof. Geo. E. Morrow was now introduced, and spoke upon

OUR FARMING—CONDITION AND OUTLOOK.

ABSTRACT OF ADDRESS BY G. E. MORROW.

Professor of Agriculture, University of Illinois.

The farmers of the United States do well to magnify their calling. It is the chief industry of the Nation, and must long continue to be such. The saying of one of our most thoughtful writers, that "the test of National welfare is the intelligence and prosperity of the farmer," is peculiarly true in our own Nation.

The rapidity of the growth of this industry, especially in the West, is marvelous. In fifteen years the acreage devoted to cereals is estimated to have increased over 90 per cent. Fully half of all the wheat and corn grown in the United States is produced west of the Mississippi river. The aggregate of our cereal crops for 1885, is estimated at not far from 3,000,000,000 bushels. Notwithstanding the rapid increase of population—now probably 1,750,000 per year, each year—with equal average yield—gives us a larger surplus of farm products for exportation. Not only do our farms feed our own people but, in recent years, they have furnished more than three-fourths of all the exports to foreign lands.

In the general past a fair return has been the rule with farmers. The circumstances have been favorable. Fertile lands, in desirable climates, have been offered almost without price. These lands have rapidly appreciated in value, so that the farm, obtained almost as a gift, often has come to be worth thousands of dollars in a decade of years. Thousands of the peasantry of foreign lands, with little money, little business training, little education and with no knowledge of the soil, the climate, or the crops of the country have risen from poverty to fair wealth within a quarter of a century.

If adaptation to circumstances be a test of worth, the farming of the United States, as a whole, does not deserve the reproach so often put upon it. There is not only excuse for many practices often complained of, but these practices—faulty indeed if used in other lands—to often have been dictated by good judgment.

Our farming should be good, for, as a class, our farmers are not surpassed by their fellows in any other land, in intelligence, enterprise, readiness in adaptation, shrewdness in planning, willingness to learn from the experience of others or by personal experiment. Their needs have made them ready to invent, and to adapt to new uses that which has already been found. Fortunately most of them have been obliged to combine in one person, the superintendent and the laborer. Through those who have come from other lands or different portions of our own, the practice in almost every region has been greatly affected by the adaptation of the best of the practice of many other regions.

As yet we are mainly a nation of land owners. Of the 4,000,000 farms in the United States in 1880, almost three out of four were tilled by their owners. Aside from the great ranches of the farther west, we are yet a nation with moderate sized farms—the average steadily growless. The average size of the farms of the whole county in 1880 was 134 acres, against 153 in 1870, and 199 in 1860. This reduction has been going on in almost every State. Only one farm in thirty-eight is over 500 acres in extent. Naturally our methods have been simple. Labor has been high-priced; the soil new and fertile. Often we have looked more to an advance in the price of the land than to a profit from our annual crops.

In one sense of the term we have had no "farming-class." Not only has it been the exception rather than the rule that a farmer should spend his life on one farm, but vast numbers of farmers have engaged in other callings, and very many of those now tilling the soil have given a part of their lives to labor in other occupations.

As they look over the past and take note of the present, the farmers of the United States may well feel fairly content with what has been accomplished, and with their condition. There have been times of marked depression; of late farm profits have been small; but the average farmer has much for which to be thankful, and not a little concerning which he may feel a justifiable pride. Mistakes have been made, some of them serious, but much that has been severely criticized has not only been excusable, but has been the best thing practicable under the conditions.

Almost without exception there is, or has been, some reason for the opinions or practices of large numbers of fairly intelligent men free to do and to think as they please. The farm practice of most sections of our country—although faulty in many respects—is better adapted to the conditions there found than would be the systems followed in other portions of the country.

It is true, however, that the mass of farmers are overly conservative. This is less true of American farmers than of those in most other lands, but even here we often fail promptly to recognize that the conditions which made our practice wise when adopted, have passed away.

In this age, men live faster than in former times. In this country we live faster than do men of other lands. In all history there are few things more wonderful than the rapidity of the development of this country. In a half, a third, a fourth of a century great States have been made from wild prairies or wilder forests. Sparsely populated regions, with lands to be had for the asking, where the hardy pioneer farmers suffered from failure of food supply or found themselves unable to dispose of a small surplus, are now thickly settled, with high-priced lands and ready means for transporting the farm products to almost any market. The comforts, many of the luxuries, and some of the evils of civilization have come where a generation back, agriculture, trade and commerce were unknown.

The supply of good tillable land belonging to the government is, comparatively, nearly exhausted. In many western States, farm lands are already held at such prices as makes it difficult for a young man without money save that which he can earn, to become a land owner. The number and percentage of tenant farmers will probably largely increase. The land-owning class, almost certainly, will become a more and more influential class, and the ownership of farm lands as a permanent investment will have greater attraction for men of wealth.

The competition to which farmers are subjected, is much more keen than formerly. The development of great systems for transportation has been such that the average farmer of the United States not only finds himself in competition with those in far distant States, but with those in far distant lands. Already it is a question of pressing importance whether we can find a satisfactory market for some of our great staples in farm products. The margin of profit between cost and selling price promises to be less than in the past. Yet, as the price of farm lands advance and the rate of advance becomes less, it becomes increasingly important that the farmer look to a profit from the sale of his products rather than from an advance in the price of his land.

Success in farming will not so certainly be the rule in the future as in the past. More of effort, of skill, of training, will be necessary. The problems to be solved will be more complicated. It will be more difficult to win success, but it will mean more, be worth more, to succeed. Farm practice must change to meet these rapidly-changing conditions. It is not wise to adopt every new system, but it is folly to cling to methods no longer suited to our surroundings. In the middle way lies safety, but better go near the overly enthusiastic disciple of the new modes than to fall back into the ranks of the "old fogies."

With decreasing margin for profit it will be increasingly important for farmers to make full and constant use of their capital, most of all of their land. Farm land was made to be used and need not be perceptibly injured by use. On low priced lands, doubling in value in one to five years, interest and taxes count for but little. On high-priced lands, almost stationary in value, these expenditures are important. Only from well cultivated lands can they be repaid. In 1880 nearly 47 per cent. of the lands in farms in the whole country were uncultivated. Of all the States, Illinois had the smallest percentage of uncultivated lands in her farms; but even here 17.5 of each 100 acres in farms was unimproved; in Missouri, about 40; in Wisconsin, over 40; in the Southern States, from 50 to 70.

So too, there must be more constant, and more widely planned use of the labor of self, of employes, of teams, and of the machinery. Other things being equal, that system of farming which requires the most labor and skill will give largest profits.

Specialties will be best for some men and some localities, but dividing of products will be safest and best for most farmers or individuals, and for most agricultural regions.

Animal husbandry, in some of its forms, will hold a continually increasing importance in our farming systems, because rearing and feeding farm animals enable the farmer to make use of lands and products otherwise nearly or quite unused; enable him to reduce the bulk of his surplus for export, making it better suited for transportation; enable him to retain much more of his produce on the farm, thus better preserving its fertility; enable him the better to have a desirable rotation of crops and, usually, to more equally distribute the necessary labor throughout the year. The continuous growth of only one grain, or of all the cereals, as the chief or sole reliable products of the farm, will become less common. What we may call the commercial side of farming,—the how, when and where to sell and buy,—will become more and more an important and complicated part of the business. The farmer should always be a manufacturer rather than a merchant or speculator; should be a "producer" rather than a "dealer," but no skill in production will make amends for ignorance or carelessness as to disposal of farm crops.

More than in the past, farmers must study economical production. The cost, rather than the possibility of production, must determine how large shall be the yield per acre or the weight per animal grown by the farmer.

Farming is a business. It has always needed to be learned. How to be a successful farmer never comes to any man by intuition. Observation, study, experience, always have been and always will be necessary in order to succeed in farming. As the business becomes more complicated and the competition more close, there will be needed a more careful preparation for the work. He who would make a noticeable success must, somehow, be above the average, and the average of intelligence and skill is advancing.

Education and good training do help in the struggle for success. Americans recognize this. A danger is, that we will be content to give our children only such advantages as we had, unmindful of the greater need.

The farm is the best of all schools in which to learn the art of farming—skill in doing the work. Farmers ought to teach by word as well as by suggestion. The agricultural meeting, for discussion or for showing products, may be a most useful school. The agricultural paper is the most readily effective and far-reaching means of teaching in this line. The despised agricultural book sometimes has much value.

In the schools proper, very much can be done to prepare the boy to be a successful farmer. The public school is the foundation. In other lands there are those who hold it a mistake to teach farm laborers even to read and write. We are only a little less narrow if we draw the line as to what is desirable for the farmer at anything less than what it is practicable to give. Not all knowledge is equally valuable, but we may make a grave mistake if we insist that education for the farmer must be exclusively what we call "practical." The trained mind is more important than the trained hand and more valuable than the undisciplined mind filled with "practical knowledge." The value of a truly practical education can scarcely be overestimated, but there should be a good foundation for it. There is a growing appreciation of the value of schools for special training. Training schools for the law or for medical practice have scores of students now, where they had one not many years ago. Rarely is there a demand for that which requires effort of body or mind until there is a clearly recognized need of it. Farmers generally have not felt there was any especial need for especial education for the farm in schools for the people, and there has not been and is not a real demand for such education. There is widespread criticism of our public schools, medical schools and law schools. But these are, none the less, thronged with students. There is much criticism of our agricultural schools, but nowhere in all the land is there a school crowded with students, who are there chiefly because they can be taught about farming. The time has now come when it will "pay" to send young men intending to be farmers to agricultural schools. None of these can "make" farmers. Any of them can give valuable help toward success in the business. There is a wide range of study any part of which may be of great value to the farmer.

Farmers are men, as well as *farmers.* In this country they have all the privileges and obligations of citizenship. There is complaint of their lack of influence. Neither declaiming about this nor lamenting it, will bring influence. The rule is that men who fit themselves to exert influence and quietly manifest that fitness are those who wield influence. The nation will neither give nor deny influence to farmers because they are *farmers*. In the long run, it will give or withhold in accordance with their fitness.

It seems inevitable that we are not to be free from the evils which have come to other nations with great population and great wealth. There are to be "classes." The men with education, training, skill, will be above and largely separate from the ignorant, the untrained and the unskilled. It is wise to do all we can to lessen these evils. A first duty is to see that we and ours have every possible help to rise into the ranks of the educated and skilled workmen.

There does not seem to be any pressing need to urge men to become farmers. If any boy or man has special fitness for any other honorable work, and can find a place, let him take it. There is need that those who are to be farmers shall have the best attainable preparation for that work. With such preparation and with a genuine interest in their work, there is no reason to look with despondency on the probable lot of the farmers who are to come after us.

There are serious questions before us, but we can look with hope to the future of our country. Few things will do more to insure its continued greatness and prosperity than to have its largest class of citizens intelligent, land-owning, working farmers.

Prof. Morrow was followed by Dr. Paul Paquin, who spoke upon the diseases of domestic animals. (For substance of his address see pages 213–225.)

His address called forth numerous questions.

Auditor—Clover seems to have killed a horse in a certain field, and cows were injured by bloating.

Dr. Paquin—Clover bloats more than other green foods, and sometimes produces asphyxia.

Auditor—Pouring water over the loins has produced apparently good results.

In reply to a question concerning hog disease, the Doctor propounded the germ theory of its origin, in cholera.

Ques.—Is not filth, etc., a direct cause?

Dr. P.—No, it is due to a living organism.

For disinfection the Doctor advised sprinkling and washing infected places with a mixture of one part of corrosive sublimate to 400 parts of water.

The Doctor cautioned the audience never to drench a horse through the nostrils, as there was danger of producing strangulation.

Muriate of ammonia was recommended for stomach indigestion in horses.

President Eshbaugh followed with an important elucidation of the necessities of our farming, of which the following is a synopsis:

IMPROVED METHODS IN FARMING DEMANDED.

By Hon. H. Eshbaugh.

The subject of Agriculture, of which we propose to speak, is too vast and extensive in its ramifications, to permit us to enter into general details in the short time alloted us. We shall, therefore, only invite your attention to a few general facts connected with the subject of the agriculture of the present day, and as they affect not only the farmer but the whole people.

Agriculture is the first calling of man; to till and dress the soil, is a Divine injunction, it was one of the first commands of the Creator to man, and is the most important of all vocations and professions; there are none that outrank it in age, usefulness and importance. It is the great employer of labor, the furnisher of prosperity, the producer of wealth, the creator of the world's happiness to mankind. It supplies the material for food and raiment for the Nations of earth; it is the support of all enterprises; it is the creator of wealth by untold millions; it is the foundation upon which free government rests.

An interest possessing such power for usefulness, and capable of distributing its blessings to the welfare and enjoyment of mankind, truly is the interest of the whole people.

History clearly demonstrates the facts that progress in civilization, in all ages, has been measured by agricultural productions; advancement of the human race, has always been in proportion to the advancement of agriculture.

Superiority in intellect and prosperity is clearly visible in every community and Nation that has cared for, fostered and developed its agricultural interest, want and degradation is as readily noticed where agriculture has been neglected.

If the labor of the husbandman should become so neglected as not to be exercised daily, or the earth refuse to give support to growing vegetation, labor would go unemployed; the merchant would be forced to close his door; the manufacturer stop his machinery; railroads suspend operations, and the rumbling sound of the moving train and warning whistle of the engine be heard no more; the ships that now float on rivers, lakes and sea would be moored and left to decay.

But with agricultural developments, resulting in greater and cheaper productions, all industries and enterprises would not only be kept in motion, but pushed to active prosperity. It is, therefore, necessary for the benefit of all classes, that the agricultural interest should be looked after and cared for, and its votaries encouraged in improved methods of agriculture, so as to make its production more successful. For agricultural prosperity is a National blessing; and its power for usefulness general in its character and distribution.

Let us, as farmers, strive earnestly to reach the improved methods in agriculture, which means a higher type of farmer, and greater certainty of profitable results. The system of improved agricultue does not only mean larger, but better and cheaper productions. For cheap production, if of good quality, may leave a profit to the producer, even at a low price in the market, whereas costly production may be sold at a loss to the producer, even at a high price.

How to produce cheaper is, therefore, an important subject for consideration. It would be unwise to attempt this by harder toil, or by a greater number of hours of labor in a day, or by over-exertion of physical powers in either man or beast. But by regular, systematized plans of operation in farm management, so as to accomplish more real service in less time and to better advantage, which would leave more time to be devoted to reading and studying agricultural science, and thereby become more practical in farm-work and its management. For practical and successful farming, the mind must be trained and well supplied with practical food, which, by developing the intellectual faculties and expanding their usefulness, will lead to system and science in farm operations.

In this age of progress, and of advancement in science, arts, literature, mechanism and trade, farmers cannot afford to remain idle and inactive; they must try to keep pace with the progressive age in which they live, and advance with the changes of the times, which only an informed mind can do. Inasmuch as successful agriculture depends on intelligent farming, why not educate for farm purposes? What we mean by educating for farm purposes, it is to educate the present farmer in practical and economic methods of farming, and the coming farmer in the science of agriculture. The best way of achieving this end is to hold frequent meeting of farmers in school-houses and grange-halls, for the free discussion of questions pertaining to agriculture, such as the following: Systematizing farm work to best advantage; how to accomplish most with least labor and expense; what crops are best adapted to our soil; how to prepare seed-bed; how and when to sow and plant; deep and shallow plowing; value of sub-soiling; cultivation of crops with a view to obtaining a yield of better quality without an increase of cost.

Keeping up the fertility of the soil is an important factor in successful agriculture; it is unwise and unprofitable to continue the old slip-shod method of farming until the productive elements in the soil become exhausted, or even reduce to half or quarter yields. It is the the part of wisdom to strive to keep the fertility of the soil as near its full capacity in productive powers as is possible. Not so much by the application of patent fertilizers, many of which are of but little value, and others of which cost half the crop is worth, but by improved methods of farming—by such a system of mixed-husbandry as will enrich the soil, and result in larger yields with an equal amount of labor, thus giving us a larger net profit. The cultivation of a less number of acres by a higher type of farming would be less expensive and, doubtless, more profitable.

For a system of mixed-husbandry we would suggest something like the following: On a 120-acre farm take 15 acres in wheat; 15 acres in oats; 30 acres in corn; 20 or 25 acres in meadow, for hay; 35 or 40 acres in pasture. We will then have sixty acres, or one-half of the farm, in cultivation; and the other half in grass, and at rest. Could not, by proper culture and care, the yield be increased say on wheat to 22 or 25 bushels per acre; oats to 40 bushels; corn to 35 bushels; hay to two or two and a half tons per acre; the pasture on 35 or 40 acres, together with the second growth of meadow, wheat, oats and corn-stubble, be sufficient to pasture from forty to fifty head of cattle in summer; the hay, together with the straw and the corn-fodder cut at at the right time (when corn is in the dough state) and properly housed or stacked, be sufficient to winter the same number of cattle in growing condition?

This yield would give 375 bushels of wheat; 400 of oats; 1,050 of corn; 50 to 60 tons of hay; 20 tons of straw; 50 tons of corn-fodder; or a total of 1,825 bushels of grain, and 130 tons of winter feed, more than is needed to winter the fifty head of cattle. These are not extravagant figures, and I firmly believe them to be within easy reach of every practical farmer. In order to obtain best resulty from this system of mixed-husbandry we must carry the practical part a little farther; we may sell the wheat in berry, but the corn, oats, hay, straw and fodder should be converted into beef, pork, mutton, wool or dairy products. This gives marketable products at different seasons of the year; and, often, advantage in the markets. In mixed-farming, under this or a similar system, where one-half of the land is at rest and improving, and the hay, straw, corn-fodder, oats and corn fed to stock growing on the farm, whether cattle, sheep or hogs, we manufacture one of the best fertilizers for building up soil to greater productiveness, thus enhancing its value from year to year. This kind of farm management would be systematic, practical and economic; it would contribute largely to pleasure and profit in farm life, and be a safeguard against drudgery and loss.

The farmers of Missouri cultivate 6,000,000 acres in corn per year; the average yield is less than twenty-seven bushels per acre. Could not this yield—by a more practical and improved method of corn culture—be increased, say even five bushels per acre, without much, if any, increased expense? Such an increase per acre would give an increased yield of 30,000,000 bushels for the State, which, at forty cents per bushel, would make $12,000,000. Divide one-half of this amount according to present rule of distribution, and it would still leave in the hands of the farmers, $6,000,000 on the increased yield of corn alone. Will it not be readily conceded that an increased yield of five bushels of corn to the acre can be made? And could not a like increased yield be made in wheat, oats, grass, etc., with but little increase in extra expenditures, by improved methods of farming? I firmly believe that it can be done, and that if done it would guide the farmers of the State safely on the highway to prosperity and pleasure in farm life.

When we view the agricultural interest from a National stand-point we are fully confirmed of the correctness of its importance and greatness, as mentioned in the beginning of our remarks. For the latest statistics show that the capital invested in agricultural pursuits in the United States is:

In farms (in round numbers)	$16,000,000,000
In farm implements	550,000,000
In live stock	1,500,000,000
A total of	$18,050,000,000
Add expenses for fencing	100,000,000
Fertilizers purchased	35,000,000
And we have a grand total of	$18,185,000,000

But it is agriculture at home to which we desire more particularly to direct your attention; we will, therefore, hastily glance at a few figures, giving the increase of productions in the State during a period of twenty years.

Kind of product.	Yield in 1860.	Yield in 1880.	Increase in 20 years
Oats	3,680,870 Bushels.	20,670,958 Bushels	16,990,088 Bushels
Wheat	4,227,586 "	24,966,427 "	20,738,841 "
Corn	72,892,157 "	202,414,413 "	129,522,256 "
Wool	2,089,778 pounds	7,313,924 pounds	5,224,146 pounds
Hay	401,072 tons	1,077,456 tons	676,384 tons.

Live stock valued in 1860 at $53,285,273, in 1880 at $95,785,273, an increase of $42,500,000.

This enormous increase in agricultural products shows great advancement, and the question arises, "have we, the farmers in this country, kept up with the improvement and advancements made in agriculture and its increased production?" If so, we have the satisfaction of knowing that we have moved with the age; and our future ambition, in farm life, should be to learn how to produce like or greater quantity of equal quality on a less number of acres and at less cost per pound or bushel.

For we must direct our attention to a different and better method of farming with a view of meeting lower market prices in the future than in the past. Not but that prices may be high on certain products; what we mean is that the average price of farm products during the next twenty-five or thirty years will average less than prices during the last twenty-five or thirty years have done.

It is for this reason that we must learn to produce at a less cost, so that the low prices will affect us less. I cannot linger to dwell on this point, but I urge you to give the subject careful consideration, and you will doubtless see that I hazard nothing in the prediction.

I appeal to the farmers to get out of the worn-out old rut, that has but little of system, no economy, and is generally short in profits. Drop the system, and adopt the new, progressive, practical one, more certain in results; make farming a pleasure; and a good season of prosperity awaits you, and will lead you to higher planes of usefulness in farm-life. It will contribute largely to National prosperity and to individual comfort, peace and contentment.

I appeal to the young men and young women, the future farmers of our land, to seek a higher elevation in farm life, by educating themselves in agricultural pursuits. I know that not all, indeed but few out of the whole number, will enjoy the advantages of an agricultural college; but all should try to obtain the very best education within reach. And until the public awaken to a true sense of American citizenship; and appreciate the importance of an agricultural education; and introduce it into the common schools in the rural districts—until this is done—you must employ other means; such as careful reading of agricultural papers, which give many valuable lessons pertaining to various branches of agriculture, and closely studying agricultural books that treat upon practical and scientific agriculture. Apply the information thus obtained, experiment and test their value; study nature in the growth and development of plants and animals; and you will learn many valuable lessons, preparatory to an agricultural collegiate-course of study, and should a collegiate-course be beyond your reach, your earlier studies will prove a valuable factor in successful farming. The sons and daughters on the farm should be well supplied with a variety of the very best agricultural literature.

The public press of the rural districts could do a vast amount of good in this direction by devoting a few columns, or a page, to practical and improved methods of agriculture. Papers of this kind would be more sought after by reading-farmers, on account of their greater value.

I am pleased to see all over our State a better feeling and more cordial relations springing up between the farmers and the people of the towns. And this is as it should be; selfish animosity between the two occomplishes nothing but harm to both, while friendly relations contribute to the advantage of both; and the more friendship is cultivated and the more permanently these fraternal relations are established, the better for all.

True manhood and christian virtue, wherever located, will not permit selfishness to control the actions of man for selfish purposes only, but direct affairs more in harmony with the "Golden Rule,"—Do unto others as you wish others to do unto you. And the more of this rule we can sandwich into our daily lives, the better will be the world by our having lived in it.

We should all unite and work co-operatively in establishing more permanent prosperity in agriculture; it is unwise to neglect it; it is unjust to permit it to shorn of its usefulness; we should seek to protect and develop it and make it a still greater blessing to the welfare and happiness of mankind.

I would like to call your attention to some of the errors and drawbacks with which agriculture is cursed, but have time to name only one, and this one affects the producer and consumer alike.

Bread and meat in the market are often controlled in price through speculative gambling by the *bulls* and *bears*, so-called, in option dealing. The law of supply and demand no longer cuts any figure in the market on bread-stuff; by the schemes employed in option dealing the prices are forced down below the cost of production one day, and the farmer is shorn not only of his profits but often of the rewards of his labor; and the next day prices are forced up beyond reason, and the consumer compelled to pay more than its real value, thus extracting from the producer and consumer large amounts to satisfy the greed for wealth. It is a mode of gambling, a game of chance, indulged in by parasites that are of little use to society. They seek to enrich themselves on the profits of other men's toil, and the situation has become alarming. It demoralizes legitimate trade; it destroys the confidence that should exist in commercial men; it taxes the bread-stuff between the producer and consumer, unjustly; it is an innovation that centralizes business, and multiplies the power of schemes and skill for selfish purposes; it has opened an era of speculation in the market that makes and unmakes prices irrespective of supply and demand; it unsettles values and produces irregularity in the markets.

Under the present practice in option dealing, *Exchanges* and *Boards of Trade* are but little else than gambling pools, where colossal fortunes are made and lost with astounding rapidity. These operators pass and repass through the markets day by day like beast of prey, seeking whose fortune they can next devour. More clearly to illustrate the magnitude of these speculative deals, we give actual figures of one year's operations in one of the markets of the country, presenting first the legitimate trade, and then the speculative deals.

Kind of produce.	Receipts, sales and deliveries.	Speculative deals.
Oats	$5,000,000	$18,000,000
Corn	32,000,000	133,000,000
Wheat	60,000,000	600,000,000
Cotton	18,000,000	1,729,000,000
Total	$115,000,000	$2,480,000,000
Excess of speculative deals	....	$2,365,000,000

Speculative deals over legitimate transactions for the year were $2,365,000,000. Can anyone doubt the fact that this affects the markets to the detriment of both producer and consumer?

They cannot, and both, producer and consumer should unite to drive the evil out of the markets; and then, again, the price of breadstuff would be governed by the relation of supply and demand, and the producer and consumer no longer be required to support gambling speculators.

Adjourned to 7 P. M.

EVENING SESSION.

Prof. Taft again addressed the audience, his subject being *Small Fruits.* (See page 291.)

Mr. Baily—Do you take old corn after year of fruiting?

Prof. Taft—Yes.

Ques.—Is deep or shallow culture of corn best?

Mr. Morse—My experience is in favor of deep and narrow plowing. I find that corn roots go down as far as the plow.

Secretary Sanborn closed the exercises by a talk on plows and plowing, illustrating his talk by the use of the magic lantern.

Many questions were asked the Secretary in his talks, but they cannot be reported, he being engaged in answering them.

MEETING OF THE BOARD AT VERONA.

Friday, December 31, the Board held a meeting at Verona.

Hon. H. Eshbaugh, Prof. L. R. Taft, and the Secretary were present.

The subjects discussed at the meeting were much the same as at De Soto.

The sessions, three in number, were well attended and many questions were asked. These questions were much the same as those reported at other meetings, and do not need repetition.

At the close of the night session, the Board was most earnestly invited to come to Lawrence county again, at its earliest convenience.

MEETING OF THE BOARD AT BUTLER.*

The Missouri State Board of Agriculture held its sixth Farmers' Meeting at Butler, Bates county, beginning on the evening of Jan. 1st, 1886, and continued through the next day.

The members of the Board were late in reaching Butler on the night of the 1st, but a good audience of farmers assembled in the court-house, and were awaiting the arrival of the train which was to bring the speakers who were to address them.

Hon. H. Eshbaugh, Vice-President of the Board, presided at the meeting, and lent dignity, grace and pleasure to the occasion.

Prof. J. W. Sanborn addressed the meeting, in the short time there was before time for adjournment, upon general agriculture, which remarks he continued the next day.

After calling the meeting to order on the morning of the 6th, the Chairman introduced Prof. L. R. Taft, who spoke on *fruit growing.*

[The substance of his talk will be found on pages 289 to 291].

Ques.—What is the remedy for bark lice?

Ans.—Some wash, such as soap-suds, is effective.

Ques.—How should apples be stored, in barrels or bins?

Ans.—Some say one way, some another; probably not much difference.

Mr. Speer did not want the idea to get out that sod was good for trees. He had not been successful in planting in sod; the trees made a weak growth and were more liable to attacks of insects.

Mr. Taft—You are right so far as you go, but if planted in sod the trees must be kept growing by the application of fertilizers, and they must be closely watched, as I said before. For the ordinary planter cultivation is probably best, but for the careful man sod is best.

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*From *Colman's Rural World.*

Mr. Speer—The theory may be right, but it won't do so to advise, for there is too much slip-shod farming, and if the advice be followed, the result will be a failure.

Mr. Durand denied that the trees of Bates county were past their prime in fifteen years. "We don't think an orchard is one until it is ten years old. My experience is like that of Mr. Speer, sod is not so good for trees as cultivation."

Mr. Thompson said he did not come to the meeting to learn how to grow more fruit, but how to raise less. "We have too much now, more than we can sell at paying prices."

Mr. Speer wanted to know if it would pay to keep up the Horticultural Society.

Mr. Thompson spoke of the great benefits to be got from the College Farm, even though it was not costing the farmers of the State anything.

Mr. Durand showed from a practical standpoint that the Horticultural Society paid, and had been organized but a little over a year. Through his connection with the Society, and through this with the State Society, Secretary Goodman of the State Society had been able to send him a buyer for his crop of apples this year, who had paid him $1,500 for the crop of 1,500 trees, the buyer taking them on the trees.

Prof. Sanborn now continued his discussion of farming, which began the evening before. He spoke of the need of a change in our system of farming, the introduction of rotation, manures and better tillage. Selection of seed was of great importance, but for lack of time would skip that and proceed to discuss stock-feeding. This is the sheet anchor of all our prosperity.

All the food shipped out of the State is done so at a loss. It can be fed within the State at a profit, although at present, as fed, if all cost and interest be counted, it probably pays no profit.

The first thing to do, to put stock-feeding on a paying basis, is to improve the pastures. Beef made on pasture costs about two cents per pound, when in the barn it costs from six to eight cents. Throughout the State there is too much shade in pastures, and anything that shades the grass injures the quality and quantity. There should always be a mixture of grasses in the pasture, for various reasons. Much more feed will be produced on a given area, and the season prolonged and the growth sustained throughout the summer.

The speaker then spoke of the importance of shelter, even in this climate, supposed to be mild. He showed by figures to which he invited the closest criticism, that on a $3,000 barn which would shelter

100 head of cattle and 150 hogs, and the feed for them for the winter, there would be $800 saved which would be lost by out-door feeding.

He would not say that it was necessary to build a $3,000 barn at once, but a beginning could be made, and as the stock increased with the capacity of the farm to carry more, the stabling could be added to. Yet the farmer who had intelligence and faith in his business would be safe in borrowing the capital needed. Capital is needed in farming if it is to be carried on most profitably, and the young man who has intelligence, energy and faith, can safely employ some of that which is always seeking some safe investment.

The Professor then went on to speak of the science of stock feeding; he explained the composition of the different animals at different periods of life, the composition of the various food and how these could be so combined as to give the greatest growth and most profitable results.

He demonstrated that with the food already grown, if all was saved and economically fed, there could be many more head of cattle kept than are now; and with rotation of crops, and a saving of the manure, the number could be still more increased.

Did our space permit, we would be glad to give a verbatim report of all that the professor said, knowing that it would be of value, but we hope our readers will be enabled to attend some of these meetings and profit by them.

Dr. Paul Paquin, the State Veterinarian, was then introduced, and gave a talk on various diseases of domestic animals, and the application of simple remedies. He referred to the value of water in treating various diseases of domestic animals. It is a remedy that is always at hand, and easily applied, and had a varied use and effect.

Ice water is an astringent, and will stop the flow of blood. When a piece of ice is placed on the flesh, the place of contact will get white, and on removing, get red. The ice drives the blood away from the spot. So if an animal or man gets cut, in the absence of anything else apply ice or cold water to stop the flow of blood. If ice water is taken into the stomach it drives the blood from the digestive organs, and impairs digestion.

Tepid water is a vomit, and can be used in cases of poison. It has a more extensive application among men, in this respect, than among animals.

Hot water is a purgative, and is also used as a blister, and for the latter use it is not so severe as mustard. It has, however, the same medicinal effect, and in cases of lung fever it can be applied by means of cloths dipped in hot water, but not so hot as to burn, but only make the skin red. It is good in all cases of intestinal diseases.

There is no reason in giving medicine all the year round, as is done in some stables. Medicine should only be given when needed, and before giving, one should know what he is giving it for. Some give laudanum in all cases of intestinal diseases, oftentimes very injudiciously.

There is a belief that horses want different treatment and medicines than man does. A story is told of a man advising the giving of a live bull-frog to a sick horse.

Condition powders are fed regularly by some horse owners who do not know what they contain. Some of these powders have almost a complete drug store in their composition. I knew a Doctor who had a sick horse but did not know what the disease was, and he gave condition powders to it without knowing their composition.

Water is the best and safest remedy if one does not know what else to apply, but before using this he should know what the disease is, and how and when to apply the water, and at what temperature.

Two-thirds of the diseases of horses are due to indigestion. Some lay everything to bots, but these probably never killed a horse. Indigestion is generally due to improper feeding.

I am often asked how to cure lampass. Some say burn with a hot iron or cut them. This does not cure, and it is cruel. This swelling of the bars of the mouth is often due to some digestive difficulty, and is merely a symptom of some trouble which must be removed before the lampass are cured.

Ques.—How should poll-evil be treated?

Ans.—The treatment will depend on the intensity of the disease. If it is before an abscess has been formed, apply a blister of Spanish flies. If the abscess has formed there should be a seton put in below it, and a passage way made for the pus to drain away. This must be done or the abscess will not heal.

Ques.—Is there any cure for moon-eye in horses?

Ans.—This is what is known as periodic opthalmia, and no treatment that we know of yet, is successful.

Ques.—How about blind teeth?

Ans.—So-called blind teeth do not affect the sight, but as they are useless they can be pulled out, if so desired; but do not knock them out with a hammer.

Vice-President Eshbaugh was called on for remarks. He said that Prof. Sanborn had told of growing fifty bushels of corn per acre, thirty of wheat, and so on. These figures had caused some to ask what would be done with all the produce if all should grow such crops. We need not be afraid of this result very soon, but the question is not so much how to produce larger crops in total quantity, but how to grow what we do at a less expense. We ought to grow what we now do on half the land that we are cultivating. It will not pay to increase our crops, and sell as we do now for less than cost.

The speaker believed that a greater diversity of crops should be raised. One set of crops was adapted to one farm, and another set to the adjoining one.

Farmers have been working too hard and thinking too little. To cultivate properly there must be thought put into the work, and there must be regularity and a system in it.

Farmers should have neighborhood meetings to discuss questions of interest to them. We must educate the farmers, and it would be well if we would start our agricultural schools at home. This science should be taught in all of our country schools. We must have agricultural books, and, above all, papers in the house for the children, hired men and others. Mr. Eshbaugh's remarks were full of interesting and valuable suggestions.

Mr. Thompson said he had been listening with much interest to what had been said of rotation in crops, etc.; there was a crop which many farmers had on their farms, and which he would like to know what would be best to follow with. This crop is the mortgage crop.

Ans.—Follow with a crop of energy, fertilized with thought and planted in the light of an improved system of farming.

Mr. Eshbaugh spoke of the crop of boys and girls which was growing upon the farms, and of the importance of cultivating them in mind and body. He said he was taking more than thirty newspapers, and his good wife takes charge of them, cuts out all articles of value and arranges them in a scrap-book, which makes a most valuable book.

Mr. L. Chubbuck, of the editorial staff of the *Rural World*, was called upon for remarks, and responded by referring to the crop of ideas growing all over the farming country which our agricultural papers were engaged in collecting, and then distributing in a compact and available form to their readers. This meeting had been a fertile field, and the crop of information large and rich. By subscribing for one or more of these papers, the readers were presented each week with a harvest, which during the year would, if used, so increase the other crops of the farm that its cost would be the best investment that could be made.

When the meeting was called to order for the last session, Mr. Thompson made a motion, which was carried, that the State Board of Agriculture be invited to return to Butler at its earliest opportunity, and hold another meeting.

Expressions of satisfaction at the results of the meeting were made.

Mr. Henry Speer announced that if all who wished to get copies of the printed reports of the State Board would give their names to him, he would have the necessary volumes sent to him and see that all got them. This method would save expense of transportation, and insure the reports being placed where they would be appreciated.

The evening was taken up by Prof. Sanborn's illustrated lecture on plows. The antiquity of the plow and its great importance as a factor of civilization, makes it an interesting theme, and with the aid of the lantern, by which cuts could be projected upon a screen, the Professor showed the forms of some of the most ancient types of plows, and those of a later date, and down to the modern steam plow.

The illustrations were acccompanied with remarks and comments, the lecturer showing that the evolution of the plow from a mere jointed crooked stick to our modern plows, also marked the progress of civilization.

MEETING OF THE BOARD AT CHAMOIS, MO.

CHAMOIS, MO.,
January 6th, 1886.

Present: Hon. H. Eshbaugh, President; J. W. Sanborn, Secretary, and Prof. L. R. Taft, of the Missouri Agricultural College.

Although the day was very cold, three well attended sessions were held, that at night was before a crowded hall.

Much interest was manifested in the meeting, and the Board was heartily invited to come again to Chamois.

It may be proper to add here that the Board has been asked in a most cordial manner to revisit each point at which it has held a meeting. In many places formal action has been taken to accomplish this purpose. The above remarks are pertinent, as this is the third year, only, of these Institute meetings. The first year the Board had to ask for a hearing. Now it receives more invitations than it can well attend to, while the interest manifested is on the increase. The great change of values of agricultural products during the last three years has arrested the attention of our farmers, and they are now seeking with some earnestness for better methods.

MEETING OF THE BOARD AT FULTON.

A Farmers' Institute meeting was held at Fulton on January 7th and 8th, 1886.

A part of the report of the proceedings of this meeting was abstracted from the *Kansas City Live Stock Record*, which part appears in quotations:

" The Farmers' Institute held here under the auspices of the State Board of Agriculture, closed yesterday, and was a very successful meeting, notwithstanding the severity of the weather. The attendance was good throughout, and much interest was manifested in the meeting. Members of the Board present were: Dr. S. S. Laws, President State University; Prof. J. W. Sanborn, Dean State Agricultural College; Prof. W. E. Coleman, State Superintendent of Public Schools; Hon. H. Eshbaugh; and Messrs. J. A. Potts and M. Fairchild Doud; together with the following gentlemen as working members: Prof. E. M. Shelton, of the Kansas Agricultural College; Prof. Spencer, Geologist; Dr. Paquin, State Veterinarian; and T. C. Thomas, Civil Engineer.

" With this array of scientific intellect, the audience doubtless felt assured that there was rich and valuable food for the mind to be distributed in abundance, and they at once settled down to receive it.

" President Eshbaugh called the meeting to order and explained its objects, closing by introducing Prof. J. W. Sanborn, Dean of the Agricultural College, who delivered a very practical address on improved methods of farming and rotation of crops. The professor gave many practical ideas that are within easy reach of every farmer, that must lead to improved methods and bring larger profits on farm investment and labor. He says a man buying a farm, owns three farms, one below the other, which he illustrates as follows; Corn is a plant that feeds near the surface of the soil, makes its growth in ninety or a hundred days during the warmest part of the season, therefore, grows on the upper farm. It is true that corns sends roots down sometimes below the first or upper farm, but when it does this it is to secure moisture, to get drink rather than food for the growing plant that produces the corn. Wheat grows in cooler weather, in the fall and early spring, and feeds in a second strata of soil, or below that of corn; hence a crop of corn taken from the upper or first farm does not materially affect the food for the wheat plant. Clover feeds still differently, its roots growing down for food to the third strata of soil, or to the third or lower farm, and does not depend so much for plant food on the first and second, or upper and middle farms, as it does on the third or lower one.

"Clover, drawing plant food from the lower farm, deposits much of it in the middle and upper farms, and enriches both for larger yields of corn and wheat. The advantage of rotation of crops is readily seen. The average yield of wheat in the State is 11.4 bushels per acre, corn 26.6 bushels, and oats 27 bushels. The Professor tninks that by rotation of crops, proper feeding of stock and saving of manure to enrich the soil, the average yield conld be brought up to thirty bushels of wheat, forty to fifty of oats, and from seventy to eighty of corn,

"This address was so interesting and so full of practical common sense based on scientific principles that it was continued during the forenoon session."

AFTERNOON SESSION.

"Dr. Paul Paquin, Veterinarian, addressed the Institute on the diseases of the domestic animals, giving causes, symptoms, care and cure. The Doctor spoke at some length of recent discoveries made as to the causes and treatment of the various diseases in the domestic animals."

He spoke at length of hog cholera or swine plague, but as the subject is fully treated in his report (see page 215), his remarks will not be repeated. The subject of abortion in cows was also discussed.

"Prof. W. E. Coleman, State Superintendent of Public Schools, gave a very interesting as well as instructive address on the educational work in the State, placing the school fund of the State, as it now stands, at $10,000,000, and said that the State now expends annually in public schools $1,000,000. The address was well spiced with practical ideas as to the methods of teaching, and the value of education applicable to agricultural pursuits.

"Mr. Thomas, Civil Engineer, and formerly of the United States Engineering Corps, read a very valuable paper on making dirt roads. The subject was treated from a scientific standpoint and contained many valuable suggestions." [See pages 234–249 of this Report.]

EVENING SESSION.

"Prof. Spencer, of the State University, gave a lecture on *The Origin of Domestic Animals*, and exhibited numerous illustrations by the magic lantern, showing the difference between the domestic animals of ancient and modern times.

"Prof. Sanborn spoke on ancient modes of agriculture, illustrating by a magic lantern the various crude implements in use in those early days; and when we compare the domestic animals and farm machinery of a hundred years ago, or even fifty years ago, with those of the present progressive age, we are not so much surprised at the enormous production of the present day."

SECOND DAY'S SESSION.

"The forenoon was devoted to stock-feeding, Prof. Sanborn leading in the discussion. He introduced the subject by saying that one of the first essential preparations to successful feeding was to provide shelter for stock, where they could feed and rest in dry quarters, and be well protected from storm and cold. Stock fed under shelter, he said, require less feed and make more growth than those fed in the cold, open air. We therefore realize greater profit on feed consumed. Food for winter feeding should be secured, and kept in the best condition. Cut timothy for hay before its bloom all drops; clover when, say, half of the heads begin to turn. Cut all grasses after dew is off, and in fair weather; rake up and put in shock the same day. Exposure of cut grass to the hot sun too long, injures it. Cut corn-fodder when the corn is in the dough state, or is going out of this stage of growth. Set in small shocks, tie with twine, and as soon as sufficiently cured, husk and crib the corn. The fodder, well tied when cut, is not untied in husking, and should be drawn into shelter or stack as soon as the corn is taken off. The fodder is then bright and green, and retains its value as food; stock like it, eat it readily, and will consume at least 85 to 90 per cent. of its bulk, and do well on it. Grass cut at the right time, not too ripe, properly cured and housed, is worth much more in making growth on stock than if cut too ripe, burned by the sun, or bleached by rain. A steer large enough to consume twenty-five pounds of hay per day, sheltered in a barn, will make one pound of growth per day; whereas the same quantity of hay, fed out-doors in the cold, will produce no flesh. Twenty five pounds of corn-fodder, cut and cured as described, with three pounds of cotton seed or five pounds of bran, will keep a steer growing. Fifteen pounds of good hay and as much good straw as a steer will eat, will produce as good results as twenty-five pounds of clear hay. Corn-fodder fed with clover, will produce good growth. A pound of clover-hay, a pound of straw, or a pound of corn-fodder will make growth. The reason of this is that each of these foods contains necessary elements for growth and flesh that are not all contained in any other one of the foods named; hence the value of the combination of foods. For successfully growing and fattening stock, we must feed with a view of securing the greatest advantage and as near the full value of the food fed as possible, for herein lies the profit of growing and feeding stock. Corn fed *ground* produces best results, but there is no special advantage in steaming or cooking food for stock."

AFTERNOON SESSION.

Dr. Laws, President of the State University, was now introduced and addressed the Institute, his subject being *Pasteur, and his work in its relation to the diseases of domestic animals.*

This talk was listened to with profound interest, for it was in the nature of a revelation. As the speaker reviewed the investigations of a master genius of the age,—Louis Pasteur,—in their relation to contagious diseases, all were made to feel that a great advance in comparative medicine was dawning upon us, whose ultimate beneficial results it is too early, as yet, to attempt to define.

The address of Dr. Laws will be printed in the next Annual Report, in accordance with his wishes.

At the conclusion of Dr. Laws' address, Prof. Shelton was introduced:

THE FARMER'S INTEREST IN LIVE STOCK IMPROVEMENT.

BY PROF. E. M. SHELTON.

Of the Kansas Agricultural College.

Mr. President and Members of the Institute:

I wish to say, in the outset, that in this talk of mine I shall aim to treat this subject of *live stock improvement* from the stand-point of the farmer, rather than that of the professional breeder.

I am glad to notice that this subject is being pressed upon the attention of Missouri farmers with great force, though the influence of the numerous and valuable herds of pure-bred stock that have already made Missouri famous, the world over, as a center of improvement in this line.

It has always seemed to me that much is said and written on this general subject of improvement in farming that must be taken with some grains of allowance, as the circumstances and surroundings of farmers differ.

For example, Prof. Sanborn has told you of many ways in which the products of the farm may be increased, and has given, in proof, the rich store of facts that have grown out of his own experimental undertakings. Of course he means that everyone of you must take these teachings and modify and adapt them to your own surroundings. Prof. Sanborn can give you facts, but he cannot do your thinking for you. You must find out for yourselves whether new experimental truths have an application to your soil, your system of farming and general circumstances.

It is, I believe, an evident truth that the unthinking adoption of the improvements suggested by scientific men, is as much to be deprecated as their unthinking rejection.

You all know of the contest between the admirers of the different breeds of cattle, and it is not surprising that the common man is sorely puzzled by the conflicting claims. One says the *Short-Horn* is the best; another is equally sure the *Hereford* is best; another, the *Jersey*; and still another, the *Polled Angus*, and so on.

What are the facts? I claim that the demonstration of the general superiority of a single breed by experiments made in one locality is impossible. I am often asked which is the best breed of cattle. And I am not ashamed to say that I don't know which is the best breed. Circumstances will make one breed the best, other circumstances may make that breed the worst. The advocates of the different breeds are constantly saying that their favorites are the best.

We must each one study the history of the various breeds, our own soil, and the peculiarities of our own surroundings; and even then the *personal equation* cuts a scarcely less important figure in stock breeding than in astronomy.

The Short-Horns may fail with an individual who would succeed with the Jerseys, and the Jerseys may fail with an individual who would succeed with the Herefords.

We must use our own intelligence, and apply the suggestions of science and experience to our own circumstances.

War is being made everywhere on the "*scrub*," as the miscellaneously bred animal is called; and yet for many farms the scrub is the best breed. Emerson says: "A weed is a plant whose virtues have not yet been found out." So a scrub may be said to be an animal whose virtues have not been discovered.

The man who undertakes to keep the pure-bred animal as he does the scrub, is almost sure to fail. This mongrel, no less than the pure-bred, is the product of his environment.

To illustrate, the Brittish Islands are famous for their great diversity of climate, topography, fertility and rain-fall; and we find three breeds of cattle, suited to each varying district.

The Short-Horns originated in a county possessed of great fertility, and well protected from the extremes of climate. On the west side of the island, exposed to the rude blasts of the Atlantic, we find a breed with thick skins, long and abundant hair, and generally long horns. In the north part, again, we find the small Highland breeds; so well suited to the severe climate, the rugged surface and the scanty pasture of that region.

The conditions and processes that have produced a race of cattle, are best suited to its continuance. The Short Horn in the Highlands would surely degenerate, and approximate to the form and characteristics of the small breeds there found.

Into Massachusetts, some years ago, a gentlemen introduced the small *Kerry cattle*, which in their native land did not breed till five or six years of age. With improved care and treatment they have grown greatly in size, and now breed when three or four years old. This fact more than any other, I believe, explains the failures of the various breeds in certain localities.

A gentleman in Kansas once introduced a herd of Short-Horns of superior breeding, into that State. At first, and with good care, they thrived abundantly; but under neglect they have gradually gone down, and have done much to injure the breed in the eyes of the farmers of that section.

I advise no man to make a change of breeds unless he has a definite purpose in view—unless he knows just what he wants, and what he expects to accomplish by the change.

I have known men who made such changes, with the vague idea of improvement, but who soon saw the folly of the change, when it was too late to escape heavy losses and disappointment.

Dr. Laws—Prof. Shelton, please describe the points of degeneration in the Short Horns of which you spoke.

Prof. Shelton—We all know the original Short Horns were coarse and scrawny brutes, short in the quarter and possessed of much offal. The cattle of which I spoke lost their massive forms, became *leggy*, and in various ways assumed the original characteristics of the race from which they sprang.

The most obvious ways in which a herd may be improved are by improvement in feed, in care, and in habit. What I mean by habit, is the use made of them. If you want *work oxen*, work them; if *milkers*, milk the females, compelling them to use all their power in that direction; if *beef*, feed well. In breeding, select such animals as have the characteristics wanted, and couple them.

Just here I am asked: What about pedigree? One says pedigree is nothing, another thinks it is everything. The truth lies half-way between these contending views. We cannot depend upon an animal to perpetuate its kind unless it has a long line of *pure bred* ancestry; a pedigree, in short, behind it. Some animals having but half or three-fourths of pure blood are better than some full bloods, but the offspring of these grades will show the characteristics of the scrub. We can look only to the pure breed for the certain transmission of the distinguishing marks of the breed.

If you wish to know whether an animal is a good one to breed from, see if its ancestors had individual merit and were free from disease, and then the longer the pedigree, the better.

Another error in selecting breeding stock is the mistake of fixing upon details non-essential, to the neglect of really useful qualities. I refer to Short Horns again, because they are more widely known than other breeds. I never heard of any one getting anything useful out of color, yet nine farmers out of ten will not look at an individual that is not red. So, many will condemn an animal because its horns have not the peculiar turn they fancy. Let us be sure that we do not base our selection upon some trivial matter that has no money value.

All the so-called *points* of an animal may be divided into two classes; first, those that are in themselves useful; second, those that point to, or vindicate the possession of useful qualities.

Why do careful judges place such a high value upon *touch*, the texture of the skin? It is of no value in itself, but it indicates a long list of qualities that are indispensable. If the touch is hard and the skin hard and inelastic, look out for a hard feeder and an animal that is slow and late in maturing. So, the flank is of very little value in itself, it is a boiling piece of low market value. Yet the good judge knows that an animal with a long, deep flank will be a good feeder, with thick flesh and good constitution.

The crops, again,—the region just back of the shoulder,—is generally ranked high, although it indicates nothing, but is itself a part of great value.

[Here the speaker held up to the view of the audience a diagram of an animal, divided into regions, to each of which was given a numerical value, making a total of one-hundred points in an ideally perfect animal.]

I consider this of great value to judges at fairs, even though the values given to each point may not be duly proportioned.

For instance, the eye is counted *two*, which I think too low a number. The eye is of no value; but back of it is a large cushion of fat, and this fat indicates the fattening tendency and the presence of fat in other parts of the body. I think this scale is worthy of the attention of breeders; and it is proposed to be used as a standard at our fairs for the use of judges, who are to decide by the use of these points, and not by a general view of the animal, alone. The judges can then give a reason for their decision, and thus avoid the bickering that now so often follows the awards made at our fairs.

The question is often asked: How can minor defects in a herd, or individual animal, be corrected?

I have seen animals, otherwise good, faulty in the flank, others in the crops, and still others that were defective in other points.

How can these faults be corrected? Generally, we are advised to correct such defects by the use of a sire that is well developed in the region where the cows are defective. There arises this difficulty, however; in attempting to correct one fault, we are quite likely to develop defects of another kind.

I know of only one way of correcting defects in a herd; and that is by employing males whose general character is good. Select, as a sire, an animal that is well developed, not merely in the region where the cows are defective, but in all other points; thus you can correct the evil of which you complain and not fall into other errors.

The farmer's interest in live stock improvement is not likely often to carry him beyond the breeding of grades. And just here a word about the selection of the sire and the coupling of animals. What kind of sires shall be used in the improvement of our common stock? An excellent general rule is never to bring together extremes—an overgrown sire with an under-sized female, for instance. Always be content to make the process of gradation, or building-up, a slow one.

If you use Short-Horns, a medium-sized, compact bull will be most likely to prove satisfactory.

The greatest improvements have, almost without exception, been made with small males; because the process of improvement is generally one of refinement—getting rid of bone, offal and other waste products. Animals of moderate size, close, blocky and compact, have in all breeds proved most useful as sires.

Couple animals that are measurably alike. Some writers even carry this idea so far as to advise the use, first of half, then of three-quarter-blood, and then of pure bred males of the given breeds.

There is a common impression that an over-vigorous male should not be used on an under-sized female on account of supposed danger in parturition. I am satisfied, from large observation in this matter, that the notion is a mistaken one. The coarse Lincoln and Cotswold sheep have been largely used upon the little Merino ewes of the East, with generally satisfactory results. Clydesdale and Norman horses have been bred to the small and even pony mares of the country, without injury to the mares from this cause.

Allow me just a word in this connection about the general subject of improved stock. The man who commences with a large herd of pure-bred cattle, with little or no experience in their management, is almost sure to fail miserably. The history of breeding shows that the man who succeeds with pure-bred stock is generally the farmer who commenced with a few animals, which were not allowed to interfere with the general farm-work. Bates and Booth were great breeders, but they were also good farmers.

The great improvements in live-stock, the world over, have been made by farmers, not professional breeders. This ought to inspire young farmers, particularly, with courage and energy in the improvement of stock. The young man who starts with a few good cows and a sire, which may also be used in connection with a herd of grade cattle, will in a few years find himself in possession of a herd of cattle that will be a mine of wealth to him, and a constant source of pleasure.

I am totally opposed to specialties on the farm. Those men have been most successful who have carried on several branches of farming in connection.

In conclusion, it seems appropriate to say that the great work now being done in your State Agricultural College should embrace instruction of the practical sort in all that pertains to the breeding and management of domesticated animals. To this end, it should be equipped with the best specimens of the different breeds of cattle, sheep and swine, so that every student has the daily opportunities for study and comparison which are enjoined in other departments of the University. I expect much from your Agricultural College in the way of disseminating correct views among the farmers of the State, in the breeding and management of live stock. It is for the farmers of Missouri to see that the College is amply equipped for the great work which sooner or later is certain to be demanded of it.

The address called forth an interesting discussion.

Mr. Erwin—I have a statement to make in reference to the use of a thorough-bred bull upon scrubs. I have excellent opportunities to observe such cases, breeding about one hundred cows a year. I have seen quite a number of instances of a white-back, scrub cow that would bring just such a calf as the cow herself, and not having the characteristics of the bull in the least. The pre-potency of the cow was greater than that of the bull.

Mr. T. B. Harris—If you had bred that cow to a grade bull, would the calf have been any better?

Mr. Erwin—I don't think it would have been as much like the cow.

Mr. M. F. Doud—Do you think the Short-Horn any more subject to degeneracy than other breeds?

Prof. Shelton—I do not. We have more instances of degeneracy in the case of the Short Horns, because they are much more common than other breeds.

Mr. Doud—I am aware that the Short Horns came from a very crude race, but do not know what kind of ancestors the Herefords and *black* cattle had.

Prof. Shelton—There are many kinds of black cattle. The Aberdeen Angus originated in Scotland, and were originally as crude and imperfect as the original Short Horns. The Herefords originated near the border line of Wales and England. It is a curious fact, that while we often talk of the dangers of *in-breeding* as affecting strength of constitution, the Herefords are counted among the most vigorous, yet they are the closest *in-bred* cattle in the world.

Dr. Laws—Tell us about the cost of such a herd of cattle as you have at your College.

Prof. Shelton—We have herds of four breeds: Short Horn, Hereford, Angus and Jersey. In 1873, the College bought three Short Horn cows, but one of them died shortly after the purchase; and one Jersey cow. We started in the spring of 1874, with two Short Horn cows and a bull; and one Jersey cow and a bull.

From those two Short Horn cows we now have about forty head. We have bought four cows since that date. We paid high prices, $1,080 for one cow, and $800 for the other. The $1,080 cow died a few weeks ago. I find we have sold some $1,250 worth of her stock, and we have some eight or ten of her daughters and grand-daughters in the herd now. The other cow brought four or five calves, and then became over fat and barren, and was sold to the butcher. We now have too many, and so will add a big sale to the attractions of our commencement next June, to which you are all invited.

Mr. Chubbuck—Is white color any evidence of weakness of constitution in cattle?

Prof. Shelton—I will answer that question as a gentleman from Kentucky once did at a cattle-breeders' association: "If the white color is indicative of a weak constitution, then what a mistake the Almighty made in putting all white animals about the North Pole." If the color is a mark of the breed, then I would stick to the color. No one ever saw a Devon that was any other color than red, I should doubt the breeding of one of any other color.

The Short Horn is the only breed that has the roan color. That is the color-mark of the breed, but they are often red, and may be white. A friend went to Canada and looked through a fine herd whose owner told him that they kept all the roans and sold the reds to the Yankees, as the red color was about all they cared for.

J. W. Sanborn—Perhaps the speaker used language that might be misconstrued in regard to farmers experimenting. I do not believe farmers should be experimenters. They cannot afford to be.

Prof. Shelton—I mean every man must use his intelligence and determine whether the suggestions of others are suited to his circumstances.

Mr. Sanborn—We can make our surroundings artificial, and have cattle adapted to such altered conditions. I can conceive that the hills of the Rocky Mountains can be made to support large, fine cattle.

Mr. Irwin—We should seek the improvement of the cattle that we find best adapted to the natural conditions of our location.

A recess was now taken until 7 P. M.

EVENING SESSION.

"Notwithstanding the storm and the mercury at zero, a large and intelligent audience were in attendance."

J. L. Erwin, a practical and successful dairyman of Callaway county, was introduced by the President.

THE HOME DAIRY.

BY J. L. ERWIN, ESQ.

Mr. President and Gentlemen of the Institute:

Dairying has in all ages of the world attracted more or less attention. The great mass of the people of Missouri dairy only to the extent of supplying their own immediate wants, with perhaps a few pounds of butter to sell early in the season when the grass is abundant, or in the fall when the calves are weaned and there is a good growth of grass. The growth of stock is the leading idea, and under all the circumstances, I am free to confess I doubt the propriety of the mass of our people attempting to engage in dairying as a specialty. But I do think a little more knowledge of the cow; the product milk; and its product, butter and cheese, would tend greatly to improve the treatment the cow receives, as well as the quality of her product.

The cow is a chemist's laboratory, combined with a certain amount of intelligence, having sensibilities that are subject to pain or pleasure. It is not necessary to worry her with a dog, to bruise her with sticks or stones, or to frighten her with rough and coarse language to teach her to obey and love you. The cow in her domestic condition is gentle as a dove, and wants to be wooed as a maiden is won. Cows are wonderfully sympathetic. The slightest expression of suffering or warning of danger will instantly arouse the whole herd. As the cow comes next the human mother in supplying the elements of life to humanity, she, next to our mothers, wants the warmest place in our bosoms, of all animals, outside the human family. Give her a warm place in your affections, give her good food, not rotten corn that the horses won't eat, give her such water to drink as you would drink yourself, a good bed to sleep on, and a warm house to sleep in,

Recent investigations of scientists show that the origin of many diseases that have heretofore been obscure is in the water we drink and in the food we eat. It is well known that *trichiniasis* comes from eating pork that has not been cooked so as to destroy the living organism in the meat; that typhoid fever and diptheria come from using water filled with living organisms that are transplanted in the human body. Heat—scalding heat—is the only agent within the reach of everyone for the destruction of those germs, once they have gotten into the water. The water taken into the cow's stomach, loaded with filth and *animalculæ* is not subjected to this heat; and hence these organisms are not destroyed, but enter the various fluids of the body. Some of you will remember about ten years ago Mr. Warren W. Tuttle, an enterprising fellow townsman, offered a premium for the best five pounds of butter. It so happened that your humble speaker was one of the awarding committee. After the awards were made he (the speaker) made the remark that all the various samples of butter were made from milk where the cows drank pond water. About a year afterwards my old friend, Grief Baynham, now dead, came to my place, and said, in the course of a conversation: "You affronted me and my family terribly at our last fair when you said you could taste pond water in the butter, for that was what you meant—but you made me think, and I am now satisfied you are right, though, I tell you, I was angered at first. If I can taste the ragweed and cabbage in the milk, why not the water?"

After you have got a good cow you must give her the best of food and drink if you would have the best of milk. As well might a miller with the best equipped mill make good flour out of mouldy wheat; our wives, good biscuits out of bad flour.

We are asking the cow to do what we cannot. It is well known to every observer that milk and flesh partake of the nature of the food eaten. My wife once raised a young goose that determined to live on a patch of cabbage. Being fat, we determined to dress and eat the goose, but so strong was the cabbage flavor, I could not eat it. I did not like cabbage then. So of ducks that feed on fish, etc. I am satisfied that as the intelligence of this country increases the quality of butter we now regard as *gilt-edged*, will rank fourth-rate. When the weeds and plants that now exert a deleterious influence are destroyed and eradicated from our pastures and meadows, all decayed food rejected, the purest of water furnished, and comfortable shelter provided in addition to the best of food, our milk and its products will have reached a perfection in supplying the wants and pleasures of the human family now only dreamed of by the enthusiast.

We come now to the process of milking. The cow's udder must first be cleared of all filth, if by any means some has gotten there. Then she must be quickly milked with dry hands. The man or woman who wets his or her hands in the milk and then wets the teats, and milks with same dropping into the pail, will not take the first precaution; and being once told, wants to be shown the stable door if the offence be repeated.

Next to the *centrifugal*, in my humble judgment, comes the *submerged* or *Cooley system* of setting milk to raise the cream. Whether it be flat-pan or submerged, the air or water must be *pure*. The remains of the breakfast frying-pan, of the roast for the dinner, not to say remains of vegetables, must not go into the same closet or refrigerator. Nor must butter be kept, if you would preserve the fine flavor, where the milk is kept to raise the cream, else it will absorb the animal odor arising from the milk and soon become rancid.

A temperature of 50 to 55 deg. Fahrenheit will raise most of the cream in ten or twelve hours, or from one milking to the next. Milk, to make good butter, ought not to stand too long. The cream then wants to stand in a room at a temperature of 65 degrees, till it begins to thicken. Then gradually reduce the temperature to between 55 and 60 degrees, to churn. It will take a little longer to churn, but the product will be such as I show you. [Here the speaker exhibited a specimen of butter from his dairy.] The great mass of country butter is spoiled by too much churning. How I wish I had known that when I was a boy. The inflexible rule was that the dasher must stand on the gathered butter. How I used to pat that butter to get it into a clammy mass so as to make the dasher stand. Now that butter was spoiled from ever making a first-class product. As soon as the granules of butter reach the size of a grain of wheat, or less, the churn is stopped, the buttermilk drawn off through a sieve, and cold water sufficient to swim the butter freely thrown on. If butter is a little soft, this drawn off and more thrown on, and allowed to stand half an hour, when the butter is lifted from the churn to a table or draining board for a few minutes. It is then spread on the table, board or worker, and the remaining water carfully wiped off, or absorbed in a damp cloth. It is then ready to salt. This, I put in at the rate of three-fouths of an ounce to a pound of butter for retail trade; and one ounce when packed in tubs, carefully worked and weighed into two pound packages, in winter or summer, and wrapped in a carefully prepared paper that excludes air, called butter paper, and delivered to the consumer as early as convenient after making. None but the best of salt must be used; and the salt itself wants to be in a clean place where the air is pure, or it will absorb bad odors and spoil the butter.

Mr. Erwin was followed by M. Fairchilds Doud, Esq., who gave a talk on *The Relation of Education to the Farmer*. Mr. Doud occupied three-fourths of an hour in exposition of the utilty of education to the farmer.

"It is," he said, "the power that is moving the world, and that man or individual who falls behind the full measure of the information of the day, must inevitably suffer. It is now too late to decry science in its relation to successful farming."

Mr. Doud has not furnished his talk for publication,

Mr. Levi Chubbuck of the editorial staff of *Colman's Rural World*, was asked to make a few remarks. He responded by referring to the importance to farmers of manufacturing industries within their counties and neighborhoods. The presence of manufactories, especially of those that work off the raw products of the farm, result in higher prices to the farmers for their products, and also a lower price for the manufactured goods, if they be such as are needed at home.

Manufacturers can pay higher prices for home products than for those they must ship from other points; and the consumer also will not have to pay transportation in addition to cost of making, on goods made at home.

Jasper county was cited as an example of a county reaping benefit from manufacturing industries. That county, the speaker said, had 22 flouring mills, which worked off the entire crop of wheat grown in the county. The crop of last season was about 1,500,000 bushels. The millers paid for this about two cents more per bushel than shippers could pay. This means at least $30,000 more to the farmers of the county for their wheat crop than shippers *could* pay, to say nothing of what they *would* have paid, had there been no mill there and the farmers been forced to sell to them.

To this may be added the profits on milling, which, at five cents per bushel, would be $5,000; then the wages of all the employes of the mills, cost of material used in building, repairs, etc., all of which is saved to the county, and would amount, with the short crop of last year, to upwards of $150,000 additional wealth to the county, because of the presence of the flouring mills alone.

Besides those, Jasper county has woolen mills, and others that work off the raw products of the farm, all of which must have this same effect of giving the farmers better prices, cheapening what they buy, increasing the consuming population, and thus making a better market in this way.

Farmers should, therefore, be greatly interested in encouraging all manufacturing enterprises in their midst.

"On the conclusion of this address, a resolution was considered and adopted, asking the United States Government to increase the usefulness of weather predictions for the benefit of agriculture; that in addition to signal flags raised at certain places, and circulars posted at post-offices, mail trains on the railroads be supplied with, and required to carry *signal flags* indicating clear weather, storms, cold-waves, and other changes; so that anyone in sight of a mail-train may see the weather prediction. Neighborhoods could arrange to hoist flags corresponding with those carried on the mail-trains,which would give warning of storms for long distances; and as soon as these signals should be raised after a passing train and seen from another point more remote from the railroad, an additional flag could be raised, and in this way nearly every agricultural neighborhood be advised of approaching storms and changes. It would be of immense value to the agricultural interest of the country, and cost but little.

"The session was closed at a late hour on the evening of the second day by the President urging all who had attended the meeting and been favored with so many practical and valuble ideas and suggestions based upon facts and sciences, to carry home with them the food furnished the mind, and to study the various subjects considered with a view of putting into practical use the methods of improved agriculture as advocated by the State Board, as it doubtless would contribute largely to pleasure and reduce the drudgery of farm life, that it would guard against loss and be productive of larger profit to the husbandman."

BUSINESS SESSION.

Thursday evening, at the close of Prof. Sanborn's address, President Eshbaugh call a business meeting of the Board, in accordance with the vote of adjournment of the annual meeting. (See page 39.) No quorum being present, the Board adjourned *sine die*, without transacting any business.

THE FARM LAW OF MISSOURI.*

BY FRANCIS WALKER.

Member of Senior Law Class, University of Missouri.

In presenting an outline of farm law, or the rules of law which more peculiarly affect the farmer's personal and material interests, we will discuss the matter under the following heads:

1st. Buying a Farm.
2nd. What the Farm Includes.
3rd. Renting.
4th. Hiring Help.
5th. Right of Way.
6th. Rights on Public Roads.
7th. Fences.
8th. Farmer's Animals.
9th. Trespassing on the Farm.
10th. Of Dogs.
11th. About Fires.
12th. Responsibility of the Farmer for the Acts of his Hired Man.
13th. Water Rights and Drainage.
14th. Of overhanging Trees.
15th. Selling Produce.
16th. Miscellaneous.

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*In response to a request of the Secretary to C. G. Tiedeman, LL B., and Assist. Prof. of Law in the State University, to prepare an article on Farm Law, the following paper was written by Francis Walker, Esq., who submitted it to Prof. Tiedeman for review.

BUYING A FARM.

In buying a farm you ordinarily want a good one, and certainly the best one that your means will enable you to procure. Generally, if you are not acquainted with a farm which you propose to buy, you will take a look at it. The owner will lead you over the fields, and if woodland be included, will indicate to you how far that extends. Representations will undoubtedly be made; and here let it be remarked, in the first place, if you should feel inclined to buy, do not fall into the mistaken belief that the law will aid you if that farmer should not prove to have a delicate sense of the Golden Rule. If the farmer should tell you that an acre will yield so many bushels of corn, or wheat, or oats, or so many tons of hay, you are presumed to have within your reach the means of information, whether you had been farmer before or not, as to the correctness of such representations, and are to exercise your judgment accordingly. It might be if the farmer should represent to you, for instance, that an acre or acres on his farm had yielded him thirty-five bushels of wheat, and he was aware of the falsity of this assertion, that you could afterwards make him liable for damages. However, it is not advisable to experiment thus, and the best thing for you always is, to judge for yourself.

Having inspected the farm and knowing the terms upon which you can have it, you should next inform yourself as to whether you are to get a clear, absolute title in case you should buy; and to ascertain this you need not go further than to the office of the county recorder. The record will give you constructive notice of incumbrances (mortgages, judgments, liens, etc.), if there be any, subject to which you would buy the farm.

It is probably well known that a mere oral bargain for the sale of land is not binding on any one. If in such case the buyer should enter on the farm and make improvements of such a nature that the parties could not be put back into their original position, a court of equity might decree specific performance, i. e., compel the seller to make a deed, provided the buyer pays the consideration. To avoid unpleasantness, some memorandum in writing of the agreement, signed by the parties as required by our statutes, should be made. If the seller should then refuse to complete the sale by delivering the deed, he may be sued for the damages incurred, or specific performance may be decreed should the buyer be ready with the money.

Interesting questions may arise if the contract of sale of the farm should be made by letter. If A should make an offer by letter to B to sell his farm, mentioning the terms, etc., B, in the absence of any stipulations, would have a reasonable time within which to accept, provided A does not in the meanwhile withdraw the offer; and the contract would be completed when B deposited his letter of acceptance in the mail. If A should make an offer and stipulate the time within which B could accept, A of course may at any time rescind the offer, provided the contract has not been completed by B. Hence, if A, living in Kansas City, should offer to sell a farm to B, living in Baltimore, sending the letter off on the 2nd of October, 1885, and B should receive the letter on the 5th, and immediately accept the offer by depositing his letter of acceptance in the mail the next day, the contract would be completed, although A sent off a letter on the 4th, retracting the offer and reaching B on the 7th. As stated before, if the offer be made by letter through the mail, the contract would be completed when the letter of acceptance was deposited in the mail; and this would be so, even if this letter were miscarried and never reached the person making the offer. If the person making the offer, after waiting a reasonable time for an answer, should then make a contract with a second party, the first party would still have a right to demand a conveyance of the land, or if it has been conveyed to the second party, he can recover damages of the offender for breaking the contract.

It should be remarked that if a contract be created in this manner by letter, the parties must agree to precisely the same thing. A person can never accept an offer, with a qualification. Hence, if a person should offer to buy a farm of another upon certain terms, and the other party should accept these terms, but annex the qualification that the offerer should pay the attorney's fee for making the deed, there would be no contract.

The deed which the seller is to execute, according to our statutes, shall be subscribed and sealed by him, or by his lawful agent, and then acknowledged or proved before some judge, notary public or justice of the peace, and certified accordingly, after which proceedings the deed will be admitted to record. It is important that the deed should be recorded as early as possible, for otherwise a third party, not having notice of the conveyance, may buy the farm and have his deed recorded first and thus secure a better title, the first buyer's deed becoming worthless.

WHAT THE FARM INCLUDES.

The sale being completed by the delivery of the deed, the land with all that it includes will be acquired. The land conveyed will ordinarily be described as —— quarter of —— section, or —— quarter of —— quarter of —— section, etc., or perhaps "extend from a certain tree in a given direction to a particular rock," etc., and said to contain so many acres, more or less. When you take possession of the farm, then, how would you ascertain how far your land extends?

At the very beginning, you may desire to erect a necessary building and evidently would look for the best timber on your farm—provided your farm is in a region where wood abounds—and this timber may be close to your neighbor's. Several circumstances may determine more or less how far your land extends; and, as such, may be mentioned the monuments or corner-stones, the length of the boundary lines around your farm, and perhaps to some extent the number of acres mentioned in the deed. The quantity of land, professed to be conveyed by the deed, is the most unreliable means of ascertaining the limits of your land. The monuments or corner-stones will govern and control all other elements of description. If the deed should thus describe the land by metes and bounds and at the same time purport to convey sixty-seven acres, in case the land should ultimately turn out to contain only forty-nine acres, the buyer could, nevertheless, not recover any of the purchase money. Evidently it would be different if the land were sold at a certain price per acre.

Where the land is described as being bounded on one side by a creek or river, it will usually extend to the middle of the current, or rather to the thread of the stream. How far the land extends on a river which is navigable, and still more what is a navigable river, are questions which are decided differently in the various States. In the Eastern States, on rivers where the tide ebbs and flows, the boundary line would extend only to the high-water mark. Suppose this were the rule in Missouri, what would become of the fertile bottom-lands which are yearly inundated by freshets? In the case of fresh water streams which are navigable, and of which only, one can properly speak in Missouri, it has frequently been held that the line extends to the low-water mark, and also that it extends to the thread of the stream. It is however certain that in our State in such instances the boundary line would invariably be held to extend to the low-water mark.

If the land were described as being bounded by a highway, the same rule as in case of a stream would govern, *i. e.*, the land would presumptively extend to the middle of the road. Of course, in this instance as in that of a stream, words of conveyance could be used which would bound the land on the outer edge of the road or on the banks of the stream.

Having dwelt on the boundaries of the land, let us next proceed to state the things which will pass with it. All standing trees would obviously pass; so would trees which had fallen to the ground. If however, trees had been turned into rails, posts, or cordwood, for the purpose of sale, such would not pass, and the seller would have the right to take them off. All buildings would naturally pass, too, except where the land had been rented at the time, and the tenant had erected them for his own personal comfort and accommodation.

No precise rule can be given concerning the things which will or will not pass. Perhaps the best that can be said is, that all such things as are actually annexed to the soil for the purpose of being permanently used in connection with the land, will pass. This naturally would not include household furniture, nor the ordinary implements used on the farm.

Fences, everybody knows, would pass with the land. But planks, piled up, which had just been purchased for the purpose of repairing, or erecting a new fence, would not pass. Doors would pass if attached to the buildings; so would window-blinds, although detached at the time for the purpose of painting or repairing. Mantel-pieces firmly attached to the chimney are likewise part of the land, as are also corn-mills attached to a post in a barn. If the seller had made it a practice to cook food for his pigs, and for the purpose had put up a kettle in masonry near the barn, he would have to leave that. Pumps attached to a cistern or well must likewise be left for the purchaser.

If at the time of sale, crops should be growing, these would pass, as everything else actually annexed. Should the seller wish to retain them, he must reserve them expressly, and this should be mentioned in the deed, as a mere oral bargain will ordinarily not be binding. These common examples will perhaps suffice to give a comprehensive idea of the things which will pass by a conveyance of the land.

RENTING.

Instead of buying a farm, a person may also get the use of one by "renting," as it is ordinarily called, and the interest thus acquired is termed an estate for years, which is created by an instrument in writing, called a lease. A lease may be created for any number of years, and the parties, called landlord and tenant, may determine upon whatever rights and obligations shall be incident thereto.

In our State all leases must be in writing and sealed. Leases not reduced to writing will only have the force of tenancies at will until there is payment and acceptance of rent. After that, a tenancy from year to year is created, and the parties incur the rights and duties as such. Such tenancy will then continue indefinitely. If either party desires to terminate it, he has to give notice three months before the end of the year, to the other party. The same tenancy exists if the tenant, under a written lease, holds over with the consent of the landlord after the lease has terminated. If, however, the tenant in any event holds over after his term has expired, without the consent of the landlord, and notice to quit possession has been given, he will usually be liable for double rent as long as he continues in possession.

The rights which a tenant usually enjoys are such as pertain to an actual owner of a farm. He can make use of the fixtures—which were discussed under what the farm includes—and would also have the right, if there be woodland, to cut such trees as he needs to keep the buildings and fences in proper repair and likewise what he needs for fuel. But, it must be observed, that he is obliged to make such use of the premises as is consonant with good husbandry. Should he cut trees needlessly, and fail to keep the buildings or fences in repair, he would be guilty of waste and liable to a suit for damages. If he should make cord-wood on the rented land, he not only would loose that, but would be subject to treble damages. In like manner, he would have to make such use of the land which he cultivates as a prudent man would in cultivating his own. It may be added that license may be given to do any of those things already mentioned, which are ordinarily prohibited, as constituting waste. As stated before, the parties may regulate and modify their rights under the law to any degree, by agreement.

Frequently land is let upon shares. Under such circumstances the parties can likewise make an agreement, and if by its terms it appears that a certain part of the crop grown, is to be received by the landlord in the place of rent, the relation of landlord and tenant, as just described, is created. The landlord ordinarily has no vested right in the crop until there is division and delivery, so that, independently of a statutory lien, before division the crop may be attached for debt as the property of the tenant.

By the terms of our statutes a landlord has a lien for the rent on crops grown for eight months after the rent is due, which lien, like any other, can be enforced against all parties having notice. Should, therefore, a person buy all the wheat grown on premises that had been let upon shares, and had notice of such a contract, his claims would be subject to the superior rights of the landlord.

In the absence of any agreement concerning the time when the rent is to be paid, it is presumed to be payable at the end of the year, or other period of time for which the premises were leased. If the tenant fails to pay the rent at the specified time, and after demand of the rent had been made by the landlord, the latter may file a statement, verified by affidavit, with a justice of the peace in the township where such property is situated, describing the property leased, and setting forth the terms upon which the land was leased, and also the amount of rent actually due, upon which, said justice will issue a summons, directed to such tenant, requiring him to appear in the court of the former on a certain day therein named, and show cause why possession should not be restored to the landlord. The justice, on hearing the cause, if he finds the landlord's statement correct, will render judgment in his favor, and decree that he recover the possession of the premises so rented, together with the rent due and costs, which judgment the constable is directed to execute.

HIRING HELP.

Upon taking possession of a farm, there will in most cases be at least three times as much labor to be done as the farmer himself is able to do. Buildings and fences may be in a deplorable condition. If he buys, he will likely expend much time and labor on the buildings, and whether he buys or rents, he will be bound (for his own benefit) to put the fences in proper condition. Under such circumstances, he will evidently need the assistance of others then more than at any other time. It then becomes important to know what the respective rights and duties are in respect to hiring help.

Formerly, and in many other States still, the rule was that if a farmer made a contract for the building of a barn for a certain price, and the barn was not completed, he was under no obligation to pay anything for the work that had been done. So, also, if a contract had been entered into for the splitting of 12,000 rails, at so much per hundred, and only 5,700 rails were split, he owed nothing. Likewise, if a farm-hand was hired to work for a year, at twelve dollars a month, unless there was a local custom of paying laborers monthly, if the hired man worked only seven months the farmer did not owe anything until the year was over and the contract fully performed. These cases are are all based on the supposition that the parties who undertook to perform, refused to do so without cause; and the contracts being entire, it was thought that the farmer owed nothing until the performance of the whole contract.

If, however, in the above-mentioned instances, the hired persons had become sick, or for any other reasons had been unable to perform the contract, the farmer would have been under obligation to pay what the services rendered were actually worth. The severity of the rule, in cases where the laborer abandoned the work without cause, has brought about a relaxation of the rule, so that if a laborer should now undertake on the first of March to work for a farmer seven months, and should leave when harvest time arrived, to go to some other place, where he could get more wages, the farmer would nevertheless have to pay the wages that had accrued then, deducting the damages which he may have sustained before he could procure some other hand. This rule would apply to any case of hiring where the farmer had received any substantial benefit.

But, suppose the farmer had discharged the laborer before performance; what then? If he has cause, as he has when the laborer is incompetent or unwilling to do the work, he would be under obligation to pay only what the services were reasonably worth. Should he discharge the laborer without cause, he would have to pay not only for the services rendered, but also whatever damages the laborer may have sustained.

Speaking of general farm work, what causes will justify a laborer in leaving his master? Rough words, merely, would probably not, and has been so held. Very likely, poor bed and food, and, undoubtedly, general bad treatment would be sufficient cause. Since it is imperative that the cattle and horses of a farmer must be fed on Sunday as well as on any other day, would a general farm hand be exempt from this work on Sunday? Inasmuch as this is necessary work and would be lawful everywhere, the farmer may certainly require him to perform such duty, and if he should refuse to feed on Sunday evening, his discharge on the next morning would be perfectly justifiable.

A contract to work for two or any greater number of years, should be reduced to writing, since otherwise no action can be brought thereon. So, also, if the contract were to work one year, and the laborer was to begin on a future day. How a farmer may be affected by the misconduct of his laborer will be considered hereafter.

RIGHT OF WAY.

It is of primary importance that, after a person has acquired a farm, he should enjoy such rights as will enable him to make the best possible use of it, and for this purpose he needs undisturbed access to the outer world. Whenever a public highway or road passes through or touches his land, he usually has an unrestricted use of it. But, suppose his neighbor's land lies between his and the public road, how can he then procure a satisfaction of his wants? If his neighbor tacitly permits him to pass over his land, he has a license; but this may be revoked at any time. A permanent right of way can be created: First, by grant; second, by necessity; third, by a decree of the county court.

The right of way by grant must be created in the same manner as a title to land, *i. e.*, by regular execution of a deed. The grantor has the right to locate the way; but if he fails, the grantee can locate it for himself. When the way is once laid out, neither party can change it without the consent of the other.

A right of way by necessity is created when a person sells land to another which is surrounded by his own. In these cases, the law implies a grant of a right of way, since it is a necessity. When, however, the necessity ceases, as by establishment of a new public road which passes through the land of the buyer, the right of way expires. It must be stated that in this instance the person who suffers the road to pass over his land is not bound to keep such road in repair. The person having the privilege to use this road must see to that; and if he should permit it to become impassable, he would not be allowed to pass over the abutting land. The owner who permits the right of way has also a right to put up a gate on each side of his land, and the other party would be liable for damages if by his negligence, cattle came into the field. A right of way for draining land may also be acquired as indicated.

The third manner in which a right of way may be acquired, is by a decree of the county court. It can be imagined that there may be many instances in which a right of way can not be created in the two modes first explained. The person desiring a private road must petition the county court, stating all the particulars, after which three disinterested commissioners are appointed. The petitioner must also present a copy of the petition to the owners of the land through which the proposed road is to pass, and if such owners reside elsewhere, publication in some newspaper of the county must be given. The commissioners are to view the premises, mark out a road not narrower than fifteen nor wider than twenty feet, lay it out so as to cause as little injury as possible, assess the damages, and make a full report to the court. If the proceedings are regular and there are no objections made by the land owners, the court will adopt the report, decree that the road be established as marked out, and render judgment against the petitioner for all the damages and costs. The owners of the land then have six months within which to remove fence and gather crops. If after that time the road is not open, the person responsible for the delay is to forfeit five dollars to the petitioner for every day thereafter during which the road remains unopened. The road, when once established, shall be open to all persons, and whenever considered of sufficient public utility by the county court, may be adopted as a county road. Whenever the necessity for such private road ceases, the county court may upon petition or its own motion vacate it.

PUBLIC ROADS.

Under the discussion of land boundaries, it was observed that if land was bounded by a public road, it would extend to the middle of it. In such a case the fee or absolute ownership in the land under the road would ordinarily remain in the adjoining proprietors. The land would only be subject to the paramount right of the public to pass over it, and whenever the public need would not require the road any more, the entire and exclusive property and use would revert to the owners, and it could be used for private purposes. The public have a right only to pass peaceably over such road, and any other use of it would be unlawful. The farmer moreover could make use of it in any profitable manner which did not interfere with the public enjoyment.

Although the farmer over whose land a road passes can make use of such land, only subject to the public rights, he can no more obstruct the road than anybody else. Should he throw in any trees, Osage orange or other brush, or plant a hedge within the lines established for such road, or should feed his cattle thereon, he would be subject to the payment of a fine not less than twenty dollars, to be recovered by information before a justice of the peace.

If persons, traveling in a wagon or carriage, should meet on a public highway, the general rule is that each party shall turn to the right. Both parties must try to avoid collision. If one does not conform to the rule and the other could avoid collision but receives injury, the latter could not recover damages because he was guilty of contributory negligence. The language of our statute pertaining to this subject is about as follows: "The persons meeting shall seasonably turn their carriage, wagon or other vehicle, to the right of the center of the road, so as to permit each carriage, etc., to pass without interference or interruption, under the penalty of five dollars for every neglect or offense, to be recovered by the party injured: provided, this section shall not apply to any case unless some injury to person or property shall occur by the driver of the carriage, wagon or other vehicle refusing or neglecting to turn to the right of the beaten track. Nothing in this section shall be construed to prevent a heavily laden wagon, when it meets an empty wagon, from retaining the right of way of track."

Whenever a public road passes over a railroad, the railroad corporation is required to have the bell rung or the whistle sounded at intervals at a distance of eighty rods from said road, and continue to do so until the train has passed over. For every neglect, the corporation is subject to a penalty of twenty dollars. The corporation will also be liable for all damages which any person may sustain when neither the bell is rung nor the whistle sounded: provided, it shall not be precluded from showing that the failure to ring the bell or sound the whistle was not the cause of the injury.

All persons owning steam engines, while traveling on public roads in our State, on meeting a person with a horse or horses and wagon, etc., are required to shut off the steam and come to a halt within one hundred yards before meeting the latter, and remain so until such person, having passed, is one hundred yards off. Persons violating this provision are guilty of a misdemeanor, and upon conviction, are to be fined not less than five nor more than one hundred and fifty dollars.

How a public road is established is not necessary to mention in detail. The main provisions are that applications for the same must be made by petition, signed by at least twelve freeholders of the township through which the proposed road is to pass, to the county court, of which notice must be given. The court will consider the matter, and also hear the remonstrance of twelve freeholders of said township. If the road should promise to be of public utility, the court will order the road commissioner to view and mark out the road, and report at the next term. The road commissioner is to receive the relinquishment of the right of way from those through whose land the road is to pass, and if any persons should refuse to relinquish, the court will appoint, by order of record, three disinterested freeholders of the county to act as commissioners, who shall then view the road and assess the damages. If, after proper consideration, upon the report of the commissioners, the court is satisfied that the road will be of sufficient utility, it will be ordered to be established as a public highway forever, until altered or annulled by authority of law.

FENCES.

Independently of statutory regulations, every farmer is compelled to keep his horses, cows, sheep and other domestic animals on his own premises. Should his cattle escape from the lot and run on his neighbor's premises, he would be responsible for damages, however certain he was of taking the highest degree of care. That his neighbor kept no proper fence would be no excuse, for there was no such duty under the law. Everybody is aware that if horses or cows are suffered to get into a field of tall wheat or green corn, they will do mischief that can hardly be estimated. The farmer must therefore anticipate that his cattle will do damage wherever they go, and hence is under obligation to keep them on his own premises. Such would be the law, if the people of a State did not consider it advisable to make the running at large of cattle and other animals lawful, and compel the owners of fields and other inclosures to erect lawful fences before being permitted to recover damages for the trespass of their neighbors' cattle.

In our State the question whether cattle and other domestic animals shall be permitted to run at large is left to the discretion of the respective counties. The general provision is, that the running at large is lawful, and that fields and other inclosures must be inclosed by a lawful fence. However, upon the petition of one hundred householders of any county, at a general or special election, the county court is to submit to the qualified voters of such county the question of restraining the running at large of any animal or animals of the species of horse, mule, ass, cattle, swine, sheep or goats. If then a majority of the legal voters, voting on said question, shall decide in favor of declaring the running at large of domestic animals unlawful, the law would stand as mentioned before, when there was no statutory regulation at all.

Upon a like procedure, the people of the several counties have the right to restrain only swine and sheep from running at large, if they so choose. By an act of our last Legislature, even the people of five townships or more, in one body in any county, may, within their territory, prohibit swine and sheep from running at large.

Now, what constitutes a lawful fence in those counties where cattle and other domestic animals are permitted to run at large? Our statutory provision reads as follows: "All hedges shall be at least four feet high, and all fences composed of posts and rails, posts and palings, posts and wire, posts and planks or palisades, shall be at least four and a half feet high; those composed of turf shall be at least four feet high, and with ditches on either side at least three feet wide at the top, and three feet deep; and what is commonly called a worm fence shall be at least five feet high to the top of the rider, or if not "ridered," shall be five feet to the top of the top rail or pole, and shall be locked with strong rails, poles or stakes; those composed of stone or brick shall be at least four and a half feet high." Could the fences in Missouri, as a rule, stand this test? The fence-viewers will inspect them whenever you bring suit against your neighbor for the trespass of his cattle. If your fence should not stand the test, and your neighbor's cattle broke into your field, you would not only have no claim for the damage done to your crops, but if you allowed your anger to get the better of your judgment, and you injured the cattle by the infliction of blows, or otherwise, you might be called on to respond for the damage thus sustained by the owner.

In those counties where a lawful fence is required to be kept, if your neighbors' cattle break into your field, you may, the first time, drive the cattle out and sue for damages. The second time they break in you may impound them; then giving your neighbors immediate notice, you are to get paid for your trouble and also for the loss sustained. If the owner of the cattle is not known, they may be taken up as strays. Like proceedings in cases of trespass are had in those counties where cattle are restrained from running at large.

Whenever the fields of two owners touch each other, both are not required to keep separate fences. Either owner can compel the other to contribute in maintaining the one fence. If the parties cannot agree as to what part one is to erect and repair, and what the other, either may apply to a justice of the peace, who, with the aid of three disinterested commissioners, will settle the difficulty. When under agreement with your neighbor in such case, he does not keep a lawful fence, and in consequence thereof your cattle entered into his field, he could ask for no damages. However, with respect to other farmers, you are under no obligation to keep any partition fence at all, and may agree with your neighbor to that effect. Hence, if in such case the cattle of a third party should enter into your neighbors' field from the want of a lawful fence, and then come across into your own field and should do you damage, you could recover.

Railroads are required in our State to erect fences, whether the counties through which they run permit cattle to run at large or not. If they do not keep a lawful fence they are responsible for all the damages that may accrue by the loss of cattle on the track.

FARMERS' ANIMALS.

What are the animals which the farmer may keep, and in which the law recognize property? Everybody knows that horses, mules, cattle, sheep, swine and fowls would be classed as such. These are usually termed domestic animals. But, may a man not acquire property in animals that originally are wild, when he has tamed them? Most certainly. A deer when completely tamed and being on one's own premises or elsewhere with a bell on, is as much the subject of property as a cow. These species of animals when running wild do not belong to anybody, but everybody has a right to acquire property in them, and whoever first gets possession holds them as property. But if a fawn has been caught and then escapes from the person's custody and runs off, anybody then would have the right to catch and own it. A species of property of this nature which is commonly met with, is that of bees. While these are on a farmer's premises they are absolutely his ; but if they swarm off he must follow them directly. Any other farmer may take them up, provided the owner does not follow them ; as long as he sees them he retains his right to them.

The animals, concerning which questions in respect to right of property usually arise, are strictly the domestic. On making a contract for the sale of a horse or other goods, wares or merchandise above the value of thirty dollars, in order that rights may be acquired, the horse must either be delivered, or there must be payment in full or in part, or something given in earnest to bind the bargain, or some memorandum in writing made and signed by the parties. One caution, though, may be given. If you are to buy a horse or mule, be sure that the person offering to sell the same is the owner ; if he is not, and the proper owner should afterwards turn up, you would not only lose the horse, but also the money which you have already paid for him.

It has been stated that is the duty of every farmer to anticipate that his horses or cattle will do injury when they leave his premises. The owner is therefore liable for damages, because he knows that all cattle will eat and tear up everything growing. But unusually evil propensities, he is not obliged to anticipate. For, is it every mule that kicks or bites a passer-by ? Or, is it every bull that will gore horses ? Such propensities the owner is not under obligation to anticipate, and for any injury sustained in consequence thereof by another, the former is not responsible unless he had knowledge or sufficient notice of the existence of this disposition in his animal. It only needs such notice as would be sufficient to put a prudent man on his guard. A farmer is not even permitted to defend his premises by ferocious animals, against trespassers. If, therefore, a boy should go to your orchard to steal apples, and there be attacked by your vicious bull, you might have to pay damages just as well as if the boy had been attacked in like manner on Sunday afternoon on coming to your house to make a social visit. You are never permitted to defend your premises by means of this nature, except perhaps when you put up placards warning everybody. Ferocious dogs will be considered hereafter.

Stallions and jacks over two years old are prohibited from running at large in our State, under certain penalties. If such animals are suffered to run at large, they may be taken up by any person, and if not claimed within five days may be castrated, for which service three dollars may be recovered. If such animals cannot be captured, after giving ten days' proper notice at the court-house door and three other public places, they may be killed. Bulls, rams and boars are allowed to run at large, provided three freeholders of the township in which such animals run about, do not give the owner thereof notice that they must be restrained. If upon notice for three days, the owner does not take up such an animal, it may be castrated by anybody; and in case the owner is unknown, it may be castrated in like manner as if notice had been given.

TRESPASSING ON THE FARM.

Every farmer impliedly invites his neighbors and other fellow-citizens to come on his premises for the purposes of business, courtesy, information, etc. He is under legal obligation to see to it that when such persons call upon him, they receive no hurt from any source on his premises. If, therefore, a person calling should receive injury from a dog, the proprietor would be under legal obligation to pay damages. So also, if a peddler, no matter how importunate he may be, should call on you, you cannot do him violence in ejecting him, provided he offers no resistance. Express permission may also be given to another to come on one's premises for a special purpose; but then that permission does not extend to any other purpose. Hence, if you sell twenty cords of wood which are on your premises, you give the buyer implied license to come on your premises to haul them off; but the buyer would become a trespasser if he should make any other use of the land, not permitted to people generally.

But suppose a person should enter your field for some unlawful purposes, as to take,—or if you prefer to say,—to steal apples, or grapes, or melons; what then? He would be a trespasser from the beginning, and you could sue him for damages. The very prevalent opinion that a person has a perfect right to hunt on another's waste grounds is quite erroneous. If the owner of such grounds should choose to insist upon his rights—however insignificant the satisfaction may be—he may bring a civil action against you. Therefore, if a person goes hunting with his dogs on another's grounds, and the dogs should kill a sheep, the owner of the dog would be liable in damages, even if the dogs had never before molested sheep.

By the statutes of Missouri, every person who enters on the premises of another for some unlawful purpose, as to take away or mutilate fruit or ornamental trees, or to take away fruit, grapes, vegetables, etc., or to take away or throw down fences, or who shall cut down or carry off any timber or trees, or who shall buy such timber or trees, knowing that the same had been taken as aforesaid, is to be deemed guilty of a misdemeanor, and as in other cases of misdemeanors may be arrested upon having an information filed with a justice of the peace. A person who hunts with a gun or dog within another's inclosures without permission, is subject to a fine of ten dollars, although he captures no game. So, there is a penalty of twenty-five dollars if a person goes to fish at a private pond, the private character of which he has notice.

It has been stated that a farmer never has a right to defend his premises against mere trespassers, by the use of ferocious animals. The same may be said of spring guns, pits, etc., and if a trespassing cow should fall into a pit and break her neck, the owner of the farm, and not the owner of the cow, would have to bear the loss. Neither are you at liberty to set poison in your field to do away with a trespassing dog that treads down your wheat. If such dog should prowl about your house every night, he may perhaps be disposed of in that manner as a nuisance. It is sometimes customary to kill a neighbor's chickens when they come into one's own field and scratch up newly-planted corn, or melon patches, and then throw them over the fence. The person indulging in this practice is guilty of a legal wrong.

Trespass may also be committed by casting inanimate objects upon the land of another. For instance, if close to a boundary line a tree were to be cut and should fall into a neighbor's field of wheat, the person doing so would have to pay for the injury. So also, if rock were blasted near a line and some fragments should be thrown into a neighbor's garden. The person instrumental in such trespass, even if there is no intention, is responsible for all damages.

OF DOGS.

Inasmuch as dogs frequently lead not only to bad feeling between otherwise good neighbors, but also at times to vexatious litigation, it has been deemed advisable not to speak of them in connection with other animals.

It is generally known that our law now recognizes a right of private property in a dog. In England, this was formerly not the law; and hence, if a neighbor enticed a dog away from another, the owner could not recover the value. But in Missouri the law recognizes a right of property in a dog, and it has been held that where a railroad corporation, through its agent, had undertaken to transport and deliver a dog at a designated point, and had failed to deliver him at that point, it would be liable for his value, which was to be ascertained by the testimony of experts.

Of a dog, unlike most other domestic animals, the trespass occasioned by running about the field of another farmer, does not usually give rise to suits, because he will not commit any noticeable injury. It would be different, though, if the owner were to send him on another man's land to chase cattle or pigs. So also, if the owner was aware that the dog had a propensity to chase game, and the dog entered a neighbor's field of wheat, and while chasing hares had trodden down the wheat, the owner would certainly have to answer for this damage. If a person was aware that his dog would bite, there would be no excuse when the dog had bitten a person, that he had been fastened with a chain, for it is unlawful to keep such an animal.

The liability of owners of dogs for injuries done by them varies very much in the different States, and will, perhaps, be changed more or less every two or four years. Independently of the statutes, enough has been mentioned to indicate what the law would be. Certainly, every farmer would have the right to use his dog in driving another man's cattle or pigs out of his field ; but, of course, if the dog should do injury, as by tearing off the pigs' ears, the owner would be responsible. A dog could be killed while in the act of tearing sheep or killing swine, whether the owner had notice of his disposition or not. And if the owner has notice of an evil propensity in his dog, he would be responsible for all injury which may afterwards be committed by him.

At present, there is no other statutory law in Missouri with respect to dogs, that concerns our farmers, except one provision in reference to so-called "sheep-killing" dogs, which reads as follows :

"In every case where sheep or other domestic animals are killed or maimed by dogs, the owner of such animals may recover against the owner or keeper of such dog or dogs, the full amount of damages, and the owner shall forthwith kill such dog or dogs ; and for every day he shall refuse or neglect to do so, after notice, he shall pay and forfeit the sum of one dollar, and it shall be lawful for any person to kill such dog or dogs."

ABOUT FIRES.

Ordinarily, a farmer is at liberty to cultivate his land in any manner that he sees fit. He may make use of whatever tools or other means that he chooses. But, when employing fire to accomplish anything, he is required to observe a degree of care that corresponds to the danger. Not observing due care, he would be responsible to his neighbor for all damages sustained in consequence thereof. While, therefore, he may lawfully set fire to stumps, brush or ditches overgrown with all kinds of weeds and thorns, on his premises, he is bound to observe all precautions. What precautions with respect to time, place, etc., are necessary to prevent spread of fire at any given place, need not be indicated to farmers. Certain it is that for any omission of due care, a person is answerable. For instance, if one were to set fire on a dry autumn day, to a hollow tree, for the purpose of driving out a rabbit, even on his own grounds, and should leave without extinguishing the fire, and it should find its way to a neighbor's fence, the former would certainly have to furnish the rails again. How it would be if a person should by smoking tobacco, while feeding his horses, set fire to his barn, and sparks should then be transmitted to a neighbor's wheat stacks, thereby igniting these too, may not be certain. Some have thought that the smoker had lost enough himself, however firmly convinced a prudent farmer might be that there was gross negligence.

It must be stated in this connection that in all other cases, as well as fires, negligence is never excusable; Let it be added, though, that if your barn or other building should be set on fire by lightning or by an incendiary, in consequence whereof your neighbor should also suffer, you are not responsible, since you cannot help that. In cases of spontaneous combustion, which may be traceable to some negligence, it might be different.

Threshers, who employ steam power, are likewise under obligation to observe due care when coming on your premises with a steam engine. Due care in their business requires, for instance, that they should make use of approved appliances for arresting sparks, and should not use machinery which is completely out of order and likely to scatter fire. Not observing such care, they would be responsible to the farmer if in consequence thereof the wheat stacks should be set on fire.

Railroad corporations are required in our State, for preventing the spread of fire, to clear off and burn up or remove all dead vegetation and undergrowth upon the right of way occupied by them, twice every year, such times being between the first and fifteenth day of August, and between the fifth and twenty-fifth day of October in each year. In case a farmer should stack his grain or hay within one hundred yards from the right of way of a railroad corporation, and sparks should be blown there from a passing train, setting the stacks on fire, the farmer could not recover for the loss.

RESPONSIBILITY OF THE FARMER FOR THE ACTS OF HIS HIRED MAN.

Whenever a farmer hires a man to work for him, he receives all the good obtainable through his services, but is also responsible for all the wrongs that may be inflicted upon others in the course of the employment. Hence, if you order a hand to cut wood, and while engaged in this work he should through carelessness strike a person passing by, you would have to bear the responsibility. So also, if you were to send him to burn dead vegetation near a neighbor's field, and by his doing so fire should be communicated to your neighbor's field and perhaps burn grain or buildings, you would have to pay all damages, no matter what specific directions you gave him, which he disobeyed. Having placed him in motion to perform the work, you must take the consequences. You guarantee to the public that he shall exercise care and abstain from wrongful acts, while acting for you.

It matters not, when a laborer works for you and inflicts an injury upon a third party, whether you directed him to do such injury, or whether he did so intentionally or unintentionally, or whether he did so negligently or even maliciously, in any event you would be answerable, provided it be done in the course of his employment. Therefore, if you sent him to town with a load of produce, and on meeting another with a wagon, he should be so negligent or malicious as to tear off a wheel from the wagon of the other, you would have to pay the wagoner's bill. But, if the laborer should commit a wrong when not engaged in working for his master, it would be different. Thus, if he should on Sunday borrow his master's horse and buggy and while riding out should carelessly run over children, or do other mischief, the master would not be responsible.

Although the master is responsible for the misconduct of his laborer to strangers, he is not so to fellow-laborers. Wherever several laborers are in the employment of one farmer, it is manifestly of the highest importance that each one should perform his duty with fidelity. To make the master responsible under such circumstances, for the misconduct of a fellow laborer, would be no less than to offer a premium for negligence. Hence, if two laborers should be ordered to haul manure and one should "fork" the other, thereby inflicting a ghastly wound, the master would not be answerable in any way. If, however, the servant inflicting such wound was notoriously incompetent and negligent, and the master was aware of this, it would be different.

WATER RIGHTS AND DRAINAGE.

Every farmer has a right to the exclusive use of the surface water —which is such as does not flow in a natural water-course with bed and banks—that collects on his premises by the fall of rain and snow. He may monopolize this. With respect to water in creeks which pass through his land, it is different. Of this he can make only a reasonable use; such as to water his horses and cattle or irrigate his lands. He may divert the creek from its natural course, provided he leads it again into the usual channel before it enters his neighbor's land. If he should cause it to enter at a different place than the natural channel, he would be liable for a tresspass. Now, inasmuch as farmers are usually more anxious to get rid of surface water in their fields than to retain it, what are their legal rights with respect to neighbors who may be affected thereby?

With regard to details, the law varies in the different States. The general rule everywhere, however, seems to be that where the surface waters are collected and cast in a body upon the proprietor below, unless into a natural water-course, the lower proprietor suffers a legal injury and may have his action for damages.

Ordinarily, the lower proprietor suffers no legal injury when the water flows freely on to his land, whether through a natural depression or otherwise. Should he feel disposed, however, not to take the water, he is not precluded from erecting a barrier on his land, although the water should in consequence be collected on the land above. However in such a case, as also in the case where the land near the line should by nature be more elevated so that the surface water had no outlet, the farmer injured thereby would still have a right, upon payment of compensation, to have a drain constructed through the other's land, provided the water could be conveyed into a natural water-course. In our State, under such circumstances, if the adjoining proprietors can not agree on the terms, suit may be instituted before a justice of the peace and the difficulty thus settled.

It has been intimated that a farmer, living on a creek, cannot deprive a lower proprietor entirely of the use of water naturally running in the creek. Respecting subterranean streams, it is otherwise. No rights attach to them. If your neighbor digs a well, and in consequence thereof your well runs dry, you could have no redress, even if he were maliciously to dig the well near the line.

OF OVERHANGING TREES.

Frequently it becomes of interest to know what the rights of adjoining owners are when trees stand on or near a line. One owner may have the land cultivated on his side, while the other has not; and on the latter's side may be tall, overhanging trees which materially injure the growing crops of the former. Further, suppose the land on both sides is cultivated, and fruit-bearing trees stand near the line. Is it not manifest, therefore, that a conflict of rights may arise in both of these instances?

A tree standing on the line is the joint property of the two adjoining owners, and neither can remove it without the consent of the other. If the adjoining owners should not know the true line between their lands, but should agree upon one, both could make use of the land and the trees on their respective sides, and neither could be disturbed in his possession until a different line should be drawn by the county surveyor, upon the request of either or both. If, however, one owner knew the line and the other did not, and the latter should go over the line to cut trees, although under mistake, the former could certainly get pay for the wood cut.

A tree the trunk of which is on one side of the line, belongs to the owner of that side. Although the limbs of the tree may be mainly on the other side, yet the owner of the tree would be entitled to the entire use of it. If the tree should bear apples or nuts, and these had fallen into the other man's field, the latter could not pick them up for his own use. They are the property of the owner of the tree, who probably would have an implied license to go across the line to pick them up. However, the other party, who has the right to the undisturbed enjoyment of his land, which includes the open air above, may cut off the trespassing limbs and branches. But he would not be entitled to make use of the branches in any way, and could only throw them over the fence, taking care to do as little injury as possible.

SELLING PRODUCE.

It has been intimated already that when any goods of the value of thirty dollars or more were bought or sold, in order that the contract might be good, there had to be some writing, signed by the parties to be charged, or delivery of the goods in whole or in part, or part payment, or something paid in earnest, to bind the bargain. So also, it has been stated that the contracting parties must agree to precisely the same thing. Therefore, if a doctor offers $95.00 for your horse, and you accept unconditionly, if nothing else be done neither can enforce the bargain afterwards. Likewise, if he should have offered you $85, and you understood him to say $185, and the horse were delivered, you could compel him to return the horse. These rules apply to all produce that you may sell.

Very often you may sell your wheat to be delivered at a future time. Suppose you sold a certain 800 bushels at 80 cents a bushel, to be delivered after two months, and the grain dealer, to bind the bargain and complete the sale, should make a part payment of $50. This bargain would be enforceable, and if lightning should strike into your granary, and the wheat be burnt up, you would neverthless receive the $590. So also, if you had bought 35,000 feet of lumber from a dealer, and had taken to your farm 10,000 feet, while the remainder had then been lost by fire, without the dealer's fault, you would nevertheless have to pay for the 35,000 feet.

Whenever a farmer sells wheat or other produce by the bushel, and no special agreement is made as to the weight thereof, the bushel shall consist of the following number of pounds, viz.: Wheat, clover seed and potatoes, sixty pounds; rye, shelled corn and flax seed, fifty-six pounds; unshelled corn, seventy pounds; onions, fifty-seven pounds; blue-grass seed, fourteen pounds; timothy seed, forty-five pounds; sweet potatoes, fifty-six pounds; turnips, forty-two pounds; apples, peaches and pears, forty-eight pounds. When apples are sold by the barrel, and no special agreement is made as to the size of the barrel, the size is to be as follows: Length of barrel, twenty-eight and one-half inches, with chines of three-quarters of an inch at the end; the diameter of the head shall be seventeen and one-quarter inches, and the diameter of the center of the barrel inside shall be twenty and one-half inches.

In order to establish uniformity in weights and measures, and to secure to each his just due, it is made obligatory upon the clerk of each county court, to procure at the county's expense, a set of weights and measures to which those of a dealer should correspond. Any person who sells, whatever commoditity it may be, by any measure or weight which he knows does not correspond with that at the county clerk's office, shall for every offiense forfeit to the person injured ten dollars, to be recovered by civil action before a justice of the peace.

MISCELLANEOUS.

How estates in land are acquired by agreement of the parties has been considered to a limited extent. At the conclusion it has been deemed advisable to make a few comments on the rights in land which arise by virtue of the marital relation, and likewise to refer briefly to testamentary dispositions.

First, with respect to the lands of the wife. By the old common law, the legal personality of the wife was lost by marriage in that of the husband. Hence, it follows that she could not be possessed of any land or other property during marriage, but that such, if she had any before, would during their joint lives be under the disposition of the husband. If the property was land, the husband had absolute control over the profits and rents. Further, if there were any issue by the marriage, and the husband outlived the wife, he was possessed of the land till he died, which estate in land was called his curtesy. After his death, the land would of course descend to the heirs of his wife. The only ordinary mode by which his rights in lands, arising by virtue of marriage, could be barred, was by stipulating expressly in the grant of the land to the wife that she should hold it to her sole and separate use, and that his curtesy should not attach.

In our State, the old rule has been somewhat modified by statute. Before this, during coverture the husband not only had absolute control over the profits and rents arising from lands, but could also convey the land to others, for the time. Now he can't convey any rights attaching to the land, without executing a deed jointly with the wife. Further, no rents and products arising from the real estate which the wife owned before marriage, or which she acquired subsequently by gift, devise or inheritance, and no moneys or obligations arising from the sale of such real estate, shall be subjected to the payment of the sole debts of the husband. Annual products only, of such real estate, may be attached and levied upon for debts of the husband, created for necessaries for the wife and children, and for labor and materials expended for the cultivation or improvement of such real estate. The husband's curtesy still attaches, however, although attempts to effect a change have been made.

If the wife survives the husband, she has a similar estate in the lands of the latter. The common law provision, which in Missouri is still in force, endowed her in the one-third part of all the lands whereof her husband had been possessed during marriage, and to which she had not relinquised her dower right by deed, jointly executed with her husband. It must be observed that the nature or quantity of the lands to which curtesy and dower attached, had to be estates of inheritance. In our State, however, the widow has also dower in leasehold estates of twenty years or more. Our statutes make several other provisions, of which the widow can avail herself and accept in the place of the common law dower. Sometimes it is to her benefit to avail herself of the statutory provision, while under different circumstances the common law provision may be more advantageous. She always had the right of election between the two.

Dower will be barred by divorce, but only in cases where the wife is the guilty and losing party. The same rule applies to the husband's curtesy. Dower may also be barred by testamentary provision, when it is expressly declared to be in lieu thereof. In this instance, the widow is also entitled to elect which she will take, the regular dower or the benefits provided, by the will. Lastly, dower may be barred by jointure, or marriage contract created before marriage, by which she is to receive any estate, real or personal, to take effect after the husband's death, and expressly declared to be in lieu of dower. It may furthermore be added that the widow's common law dower is never subject to the claims of the husband's creditors.

Estates in land may also be acquired by inheritance or devise. By inheritance the land descends to those on whom the law casts it, and this happens when the ancestor makes no will. When the ancestor makes a will, pointing out those who are to take, it is called, taking by devise.

Every male person, twenty-one years of age and upwards, of sound mind may, by last will, devise his real estate, saving the widow her dower. Every married or unmarried woman, eighteen years of age and upwards, of sound mind may likewise, by last will, devise her real estate, subject to the husband's curtesy. Every will must be in writing and subscribed by the testator, or by some person by his direction, in his presence. Two or more competent witnesses must also subscribe their names to the will in the presence of the testator, but may do so at different times.

A will may be revoked by the testator by any act of his which shows such an intention. In case it should be destroyed accidently, or in any other way, except intentionally by him or by his direction, if the contents could be established otherwise, the will would still be good. But if he should tear, burn, or cancel it, or make a different will, doing so himself, or having it done by his direction, the will would naturally be revoked.

A person who feels disposed to disinherit one of his children, must mention the latter's name in the will. If he disposes of all of his property without making provision for one whose name is not mentioned, it will be presumed that such child had been forgotten.

In conclusion, let it be suggested that whenever you ask legal advice, particularly with reference to questions that may materially affect your rights in lands, always consult a reliable and competent attorney. It will be the cheapest in the end, besides saving unnecessary trouble and unpleasantness. A legal address to farmers must of necessity be elementary, serving them merely as a general guide, rather than a reliable aid in the determination of any special question of right. It is one thing to know the rule of law, and it is another and more difficult thing to apply it to a particular state of facts. If the agricultural world of Missouri is in any way, or to the smallest extent, aided by any suggestions or explanations contained in this paper, the writer feels that he is amply repaid.

LAWS RELATING TO FORESTRY.

The great interest being developed in Forestry gives interest to the following State laws on the subject, which laws seem to be generally overlooked:

Sec. 5697, of Revised Statutes of Missouri. Bounty for planting trees.—Every person planting one acre or more of prairie land within ten years after the passage of this act, with any kind of forest trees, except black locust, and successfully growing and cultivating the same for three years; and every person planting, protecting and cultivating for three years, one-quarter of a mile, or more, of forest trees upon his own land, to be set not more than one rod apart, and to stand at the end of three years not more than two rods apart, shall be entitled to receive for fifteen years, commencing three years after said grove or line has been planted, an annual bounty of two dollars per acre for each acre so planted, and two dollars for each quarter of a mile so planted, to be paid by the county. Said bounty shall not be paid any longer than said grove or line of trees are kept alive and in growing condition.

Sec. 5698. Plat to be filed.—Any person wishing to avail himself of the provisions of the preceding, shall, within three years after planting said grove or line of trees, file with the clerk of the county court, a correct plat of said grove or line of trees, showing on what section said grove or line of trees is situated, attested by his own oath and the affidavit of at least two householders of the vicinity, setting forth all the facts in relation to the growth and cultivation of said grove or line of trees.

Sec. 5699. Duty of county court.—The county clerk shall present said plat and affidavit before the county court, and if the court find from all the facts derived from the plat, affidavits and other sources, that section 5697 has been fully complied with, they shall issue a warrant on the county treasurer for the amount found due.

Sec. 5700. Certificate receivable for taxes.—Such certificate shall be received and taken by the collector of revenue of the county in which the same was given, for county taxes, and such collector shall be allowed credit to the amount of such certificate on behalf of the county.

DRAINING FOR STOCK WATER.

By James Williams, Esq.

Some thirty years ago, when the *Valley Farmer* was edited by E. K. Woodward and Ephriam Abbott, I was a constant reader of that paper and of many other publications and reports; and got the idea grounded in my mind that artificial springs could be made by deep tile drainage in many weedy, springy sloughs, that would result in drying the land and at the same time furnish an abundant supply of stock water, especially during freezing weather in winter.

I have gathered all available information, from any and every source, but the great drawback in our locality—Cameron—was the high price of tiling. We have no tile factory in this vicinity, and the freight on it is more than the first cost. But notwithstanding the fact that I had to pay $27.50 per 1,000, for three inch tile, I hazarded the experiment of laying something over half a mile in 1884. This year (1885) I have laid about one mile, my tile costing 33 per cent. less than in 1884. The result of last year's draining has been very gratifying indeed, as well as very profitable.

I will subjoin a description of the work:

We commenced our ditch where we had a nice outlet, to drain a long, sloughy, springy draw in the prairie. It was always too wet to get anything to grow on, until so late in the season that no crop would mature, being covered with big, rough slough grass, and in the wettest part with a kind of hooked, bearded, rough grass, unfit for anything.

We dug the ditch on an average of four feet deep, keeping the grade of the bottom as nearly uniform as possible, so as to avoid little depressions or humps for the fine sand or soil to lodge in, and obstruct the flow of water. But in our case, in this particular ditch, we had no trouble, for we had plenty of fall. But in draining very level land it is all-important to have the grade uniform along the bottom of the ditch, as otherwise the tile will choke, there not being fall enough to keep it clean.

We had not dug a hundred yards before the water began running, and it increased as we proceeded until it became very troublesome. However, I encouraged the men, and they stayed by it bravely until finished.

I will say here, that of the many thousand dollars I have expended in improving my lands, I have never made an investment that benefited my farm one-tenth part as much as this one ditch.

We put in three inch tile for the main, with two and one-half inch for some side ditches—two and one-half inch tile makes a very good drain where there is plenty of fall. To avoid tramping in the mud and water while laying the tile, I took a piece of fencing board six feet long, and nailed to it two pieces of old *O. G. moulding*, placing the thick edge out and the thin edge to the center of the fencing board, thus forming a nice trough. I laid six or seven tiles, and placed the trough over them, standing on it and laying three or four tiles at a time, then drawing the trough along end-wise on the tile laid, being careful all the time to jam the tiles up close, and to leave them in as straight a line as possible.

In dry and shallow ditches, say 2½ to 3 feet deep, the trough is unnecessary, and is perhaps superfluous where one has improved tools for tile laying. The tools that we used were spades, about 17 or 18 inches long, and 5 or 6 inches wide, and made of the best steel. We had a long, narrow spade for cleaning out the ditch, but it was nearly worthless, the handle being too straight, and consequently we used it very little.

After having laid the tiles nicely in the ditch, the next thing was to put some old hay or corn-fodder in the ditch on the tile, so as to press gently and evenly on them while the ditch was being filled.

Whether this is necessary or not I cannot say, but am inclined to think that it is not. We did not put any on the tile laid this season.

When we used no hay or similar material to hold the tiling in place, we took a long, sharp spade and caved a little of the clayey subsoil off the sides of the ditch, to hold it evenly in line while the ditch was being filled by the plow.

COST OF LAYING TILE.—For drainage alone, it is somewhat expensive in this locality, but the cost depends very much on the depth of the ditches and the size of the tile used. We have drained two lakes, and have dug several rods of ditch six and seven feet deep, using four inch tile in this deep place for fear of a checkage. I let the most of my ditching out by the rod this season. I paid for the deep ditches, averaging six feet deep, in loamy soil, $0.50 per rod; for ditch thirty inches deep, in soddy and grubby land, $0.20; and in smooth, level land for ditch thirty inches deep, at the bottom of a deeply ploughed furrow, $1.00 per 100 feet; I laying and covering the tile.

The man who dug the ditches made on a average for the whole job, about $1.50 per day, he boarding himself, and I furnishing a house for himself and family. From what I have seen of the business, I think that $1.00 per 100 feet, at present prices for living, an equitable price for ditch thirty to thirty-three inches deep, which, if dug in the bottom of a deep furrow, will average about three feet deep, or as deep as I find it practicable to dig for drainage alone.

But where stock water is wanted or expected, the deeper the ditch the better.

Now, it is not to be taken for granted that every little sink or slough will make a living spring; yet, on the other hand, there are many boggy, springy places which by draining properly will supply an abundance of stock-water in winter time, when water is so badly needed; and at the same time reclaim a piece of land and render it cultivatable, which, were it not drained, would produce only malaria, weeds and frogs, and be a barbor for snakes and vermin.

When laying a drain for stock-water, take one tile to a tinner's shop, and have a heavy galvanized iron pipe made, the size of the tile, and six feet long. See that it fits into the tile snugly. Box the pipe with two-inch planking five feet nine inches long, leaving three inches of the pipe uncovered.

Sink the tank which is to catch the drainage water into the ground a little over half its depth. Cut a round hole in the end just the size of the pipe before mentioned. Insert the pipe snugly in the hole in the tank, jaming it up close so that the shoulder of the box on the pipe will come up to the tank and fit tightly.

Now you have the tank at one end of the pipe, and a tile at the other, to begin with . Lay a few tiles, and with some tough, black clay tamp the tiles, gently at first, and fill the ditch with tough clay for some ten or fifteen feet from the tank.

If you have done all this properly, if the ditch has a pretty good fall, and if there is plenty of water, you will have as good a watering place as anyone could wish. I have just such a spring as has been described, and it would do your heart good to see it on a cold morning, with the thermometer below zero, smoking like some great fountain of Nature's making. I verily believe that my tile spring would have furnished water enough last winter, cold as it was, for 500 cattle and a like number of hogs. It has stopped running only about ten days—in August—since constructed. However, the falls of 1884 and 1885 were not as dry as some, and last summer was rather wet.

I am of the opinion that in a very hot, dry season it would be dry through the latter part of such season, but believe that there will always be plenty of water in cold weather, although the weather should be dry.

The slough through which the ditch ran was, as stated, a wet, springy, cold and sour piece of land, unfit for any crop. We have planted corn across it in the dryest places, several times, but never raised anything except weeds. We plowed up the soil last fall, after it had drained out dry. The sod was very tough, as it was mostly slough grass. Being plowed under very late in the fall, the sod did not rot much. This spring, which was very wet, when we plowed the field—a rolling piece of land—the slough was the dryest part.

Consequently we plowed when others could not get into their fields for miring down. And the same way with the planting; we got a tolerably good stand of corn, notwithstanding the wet and cold weather. We did not get as good a stand on the slough, owing to its being very soddy; yet raised good, sound corn there; in fact, about the best in a field of fifty acres, averaging about forty-five bushels to the acre.

There is one drawback, however, the land being rather rolling with considerable fall, there is great danger of the ditch being washed out and ruined in a big freshet. But this can be guarded against.

I have another running spring, although not so strong as the one described. It is off in a remote corner, and is fed by about fifteen rods of ditching, only. Yet I think it ran all summer, and would have furnished water enough for the stock of an ordinary eighty-acre farm, had there been a tank of sufficient size to hold all the water.

To those proposing to lay tile for stock water, I would say, again, that the living water must be near the surface of the ground to insure a supply in dry times. The great office of the tile is to collect and carry the water to a point where it can be utilized. Every one must exercise his own judgment as to whether or not it will pay him to ditch for water alone. But in this county, where the wooded ravines head, and there is a long draw heading out in the prairie, nine times out of ten there are springs and seeps the water from which, if collected and carried to a convenient place, would make a fountain worth four times as much as most wells and wind-mills, and secured at far less trouble and expense. The only trouble attending them is the liability of their being washed out by heavy rains.

BULLETIN NO. 17.

GENERAL OBSERVATIONS.

MISSOURI AGRICULTURAL COLLEGE,
COLUMBIA, Mo., Sept. 24, 1885.

S. S. LAWS, LL. D., *President University of Missouri:*

SIR—The College Farm has attempted to test many of the grasses and forage crops that are seeking public favor. It has met with an experience that is doubtless common. Most of our grass seeds, not of common growth, have proven failures with me, from a reason that deserves attention. Seed that is of rare use is probably held over by dealers until the per cent. of germination is small, so small that the spontaneous growth of the soil smothers the plants desired, unless drill culture be adopted, with hoeing. I have had repeated misfortunes with rare grass seeds and other rare plants, and have reason to believe that farmers receive discouragement from like reasons, the result of which is to check the spread of experience with our newer varieties of grasses whose seed is not much called for. Of twenty-five varieties of grasses and clovers sown during the past year at proper times, but few have made a fair stand, most of the seed failing to germinate.

Johnson grass (sorghum halapense) was sown two years ago last fall, very early, and again this spring. The small proportion that germinated did not thrive on our heavy soil and did not seem calculated for our climate, dying in winter. The high praises given it in the South, its more natural habitation, for its abundant yield and drouth-resisting qualities has induced, I judge, seedmen and others to encourage its use too far north, where it is not likely to become popular. Its price, 25 cents per pound, with a bushel of seed commended per acre, makes it quite costly.

Alfalfa or lucern (Medicago saliva). Alfalfa belongs to the same family as the clovers and in its most appropriate field fills a place that clover cannot. It has been sown here for three seasons, with indifferent success. A deep, dry soil and a warm climate is its normal abode, and doubtless it will not thrive here on our compact subsoils as it is represented to do in Southern California and Mexico, although upon our more open soils of some parts of South Missouri it may do better. It is slow in securing a good hold of the soil, and those trying it should be patient in awaiting results. So far as at present advised, I cannot recommend it to farmers who till the average Missouri farm with its close subsoil, such as is found at the College Farm. But red clover thrives well in this State, and where it does thrive, I believe that no member of its family of plants is now known to be superior to it. Clover can easily be carried to four tons per acre in two crops, growing 7,200 pounds of dry matter per acre, which is more than is gained in rank growing corn when sown for fodder alone. Very few appreciate the value of red clover to us.

Vetch (Vicia sativa) and sainfoin are two other plants belonging to the same family and are often praised, and like Alfalfa have for sixty years been before the public, patiently awaiting their approval. Vetch secured a lodgment on the granite soil of my earlier farming, and has continued to spread to the present time, being much relished by stock, its small peas being very rich, and its tender vine nutritious and palatable. Vetch has been sown for two years here, both of which have been very wet. Under these conditions the plant has made a sickly growth and has disappointed me. Probably the winter vetch would do better in our climate and realize something of the praise accorded to it abroad. Sainfoin has given no better results than the vetch. Doubtless close, compact subsoils and heavy soils, in wet seasons are not congenial to it.

Field lupins, of the same family as the above, made a good start during the past spring but did not prove a successful crop.

Prickley comfrey is another forage plant that has received high praise for its immense yield and good qualities, and has been pushed upon the market at high rates. This plant has made a fair growth from the cuttings purchased, but does not, on our fairly fertile soil, produce four or five crops in a season, and is not relished by our own cows—they will not eat it. I believe that our farmers have a plenty of better and more available crops than the above at command for stock food.

Soja bean. This plant has come to us from Japan, where its pea is used for human food. It has been offered in this country as a stock food without coming into use to any noticeable extent. Its analysis by Prof. Caldwell of Cornell University represents its seeds and pods as very rich, as the following shows:

	Seed.	Pod.
Albuminoids	38.62 per cent.	6.36 per cent.
Carbhydrates	29.24 "	40.75 "
Fats	16.80 "	0.97 "
Fibre	4.03 "	37.45 "

The proportion of fat and albuminoids is very large. But few plants sprouted from my first crop, but from the seed obtained from this crop, a most perfect germination was secured the second year and a very rank, prolific crop gained, the plant standing from three to three and half feet high. I am not prepared to recommend it for use upon the American farm, without further experience with it on a more extensive scale. That it will thrive, I have no doubt, and that it is very nutrious is quite certain. When I have found what the animals will do with it in any quantity, I will report more fully.

Egyptian corn, or rice corn, as a drought-resisting forage crop received, a few years ago, a high degree of praise in Western Kansas and other localities. Prof. J. M. McBryde of the University of Tennessee, made trials of it, and made a flattering report. The plant has the characteristics of the sorghums in growth, with the peculiarity of growing with its head turned sharply down. Its compact panicle is richly loaded with a small light colored grain, which is often reported to yield a crop of seed that does credit to corn. Its method of culture is like that of corn or of sorghum. While its praise for its drought-resisting quality has been its main advertisement, it gave upon the College Farm, on moist ground, a good yield of fodder that was relished by stock. I can see no valid reason why the farmers of our climate and soil should give it any attention, either for its seed for the family or its seed-stem for stock, the corn plant being preferable.

Rural branching sorghum, or milo maize. This plant, brought prominently before the farmers by the Rural New Yorker, claims a more favorable notice as a forage plant. It has remarkable tillering propensities, and a very large proportion of leaf to stem-growth. When cut to the ground new and often, an increased number of shoots spring up and gain a luxuriant leaf-development for a second crop, which cows are very fond of. It made a good growth on the College Farm, and will warrant attention by those who are looking for some substitute for our common corn and clover.

We have not in view, at present, for a climate of average rain-fall and of fair soil, the superior of these crops (corn and clover) for their seasons of growth.

For three years I carried on very careful experiments during the summer season with green food versus dry food for cows, weighing food, growth or decline in weight of cows, weight of milk and weight of butter. With the present price and plentitude of good pasturage, clover, timothy and grains in Missouri, I very seriously doubt the propriety of handling, daily, in little lots by high-priced labor, water-laden, green food for our dairy or other herds.

The College expects to have about fifty of the more promising varieties of grass under culture, in quantities sufficient for cattle tests. It now has thirty acres of pasture in mixed grasses of eight varieties, sown in the fall of 1883 and spring of 1884.

If our reports seem untimely to the public, they will remember that the feeding problems that interest Missouri most, cannot be carried on at this place from lack of suitable buildings, which are unprovided by the State.

Respectfully submitted,

J. W. SANBORN.

BULLETIN NO. 18.

SUBSOILING.

MISSOURI STATE AGRICULTURAL COLLEGE,
COLUMBIA, MO., Nov. 27, 1885.

S. S. Laws, LL. D., President University of Missouri;

SIR: In transmitting Bulletin No. 18 to you, I shall take occasion to present the subject of subsoiling in a somewhat general way, in response to the general interest manifested in the subject in this State. My immediate reason for departing from the mere presentation of facts gathered here, is the receipt of a letter of inquiry from one of our ablest citizens as I was on the point of writing this bulletin upon another series of trials. In thus meeting this inquiry, I suppose I meet a general want.

The belief is very general that the "basement story" of Missouri soil is as rich, or richer than its working area, as now used. Plants grow upon fresh soil from deep areas of the farms of this State with rare success.

Dr. Litton found on white oak lands, which are not regarded the best, and upon rich crow foot lands, the following results, which I have abbreviated by giving the more important materials, without affecting their teachings:

	WHITE OAK LANDS.		CROW FOOT LANDS.	
	2 to 6 inches below surface Per cent.	10 to 12 inches below surface Per cent.	6 inches below surface. Per cent.	18 inches below surface. Per cent.
Peroxide of iron	2.055	3.881	0.473	0.329
Lime	0.208	0.472	0.473	0.329
Magnesia	0.342	0.689	0.452	0.445
Phosphoric acid	6.056	0.055	0.235	0.342
Potash	0.336	0.389	0.295	0.332
[illegible]uric acid	0.003	0.009	0.026	0.026

The laboratory and the plant (the plant in the subsoil exposed on the surface for a while) are in agreement in placing a high value upon the subsoils of Missouri. The conviction has grown in the minds of many that the subsoil plow will make this soil available. Will it? If so a mine is opened, richer than California's gold mines, and a new State is discovered beneath ours.

Bulletin No. 5 of this College, of the date of Nov. 14, 1883, detailed the results of the first year's trial of subsoiling. One 77-100 per cent. more moisture was found in the subsoiled plat than in the un-subsoiled plat, and 20.8 bushels more of corn was received on the subsoiled plat; also 712 pounds more of corn-fodder. The equally interesting fact was noticed, that the ratio of corn to fodder was greater on the subsoiled plat. The season had a severe drought.

The same plat was subsoiled again for 1884 and gave reverse results, but owing to the loss of some hills of corn, these will not be used in this connection.

In the main corn field, a long narrow section was subsoiled through an un-subsoiled field. Before giving the results, I may note that subsoiling is not the inversion of a deep furrow, as it is often supposed to be, but is the following of an ordinary-turning plow by a subsoil plow in its track, beginning in depth where the ordinary-turning plow leaves off, and simply stirring the soil to a deeper area without inverting it. It leaves the soil substantially where it originally was, but loosened. The philosophy of its action is supposed to rest, in the main, in deepening the root area of the soil by breaking its impenetrable crust, and thus inviting the roots into new feeding ground. Once loosened, the air is thought to circulate more freely through it and by its oxygen and carbonic acid gases to disintegrate the soil, and by chemical reactions to sweeten it, or fit it to nourish plants. This area becomes also a greater water-holding area, admits greater freedom of capillary action, hence in drought furnishes more moisture for the plant, as seen by my tests for 1883.

August 11, when no rain had fallen for eleven days, the un-subsoiled plat for 1884 contained 9.16 per cent. water, and the subsoiled plat contained 11.16 per cent. water. Assuming an acre of soil to weigh 5,000,000 pounds to the depth of fifteen inches, we get an increase of 100,000 pounds of water for subsoiling, per acre. The yield was, for subsoiled section 52.1 bushels corn, 4,325 pounds corn-fodder and 83 pounds corn-fodder per bushel of corn.

The un-subsoiled section gave 62.8 bushels corn, 5,104 pounds of corn-fodder, and 81 pounds of corn-fodder per bushel of corn.

Here is a reversal of the results of 1883, in returns, but the returns are not necessarily discordant. The season of 1884 was cold and wet to excess in Boone county, and the 100,000 pounds of extra water in our subsoiled plat was unneeded and doubtless was pernicious. In this wet, cold area the roots of corn would find no congenial field.

SEASON OF 1885.

Wheat ground was subsoiled, but by an error of the Farm Manager, who gathered the grain in my absence, the figures were lost for one of the plats. More moisture was found in the subsoiled plat and, by the eye, I could discover no difference in yield. Twenty bushels per acre on one plat was the result, about three times the State and, county average, and was no better than the wheat in the section of field in which it grew.

Our corn field gave for subsoiled section 14.2 per cent. of moisture, while the un-subsoiled section gave 10.4 per cent., a difference of 3.8 per cent., or for 15 inches depth, the depth to which all my plats are subsoiled in these trials, 190,000 pounds of water per acre.

Corn yield for section subsoiled 93.5 bushels per acre of 80 pounds per bushel, and un-subsoiled section gave 97.8 bushels. This stover or corn-fodder was not weighed. In regard to this yield I may say, as a matter of interest, that the plats were one-tenth of an acre and were in the midst of our regular corn field, and were planted and handled precisely as the rest of the corn field.

Plats 18 and 19, started three years ago, and subsoiled in 1883 and 1884 were left un-subsoiled for 1885, but planted to note the results. Moisture in subsoiled part 17.1 per cent., in un-subsoiled part 11.9 per cent. Yield of first 26.3 bushels corn, and 3,300 lbs. corn fodder or 122 lbs. fodder to 1 bushel of corn. Un-subsoiled plat gave 25 bushels corn, 3,000 lbs. fodder and 120 lbs. fodder to one bushel of corn. Corn after corn compares unfavorably with our higher system of farming by rotation, on the commercial part of the farm.

FOR POTATOES.

The potatoes were subsoiled under each row and showed 2.4 per cent. more moisture in the subsoiled rows and the crop was as 108 to 335, or subsoiling again disappoints us. These potatoes I shall refer to more fully in a subsequent Bulletin. We record a wetter season than that of 1884, and suppose the character of the season has influenced the result.

Seven trials on this farm in three years, show more moisture in subsoiled plats every time for each crop. The average is for subsoiled plats 13.7 per cent. and for un-subsoiled plats 10.5 per cent. moisture, or the former is 30.4 per cent. greater than the latter—a potent force for good or evil as the season may be.

The average yield of corn is for four years, subsoiled section 60.5 bushels and 4,012 lbs. fodder, and for un-subsoiled section 58.7 bushels of corn and 4,119 lbs. fodder. The great gain of the first and dry season, fully ballances the losses of the past two seasons in yield. This does not consider the cost of subsoiling, which is a little more than the cost of surface plowing, or about one horse more on the team.

EXPERIMENTS BY OTHERS.

The value of these trials can be better measured and our judgment upon the value of subsoiling better formed, by adding other careful data. I found none where soil moisture had been taken.

In the report of the National Department of Agriculture for 1872, occurs the experience of Mr. S. M. Wherry of Pennsylvania, covering eight years of time. His observations seem to have been unusually critical and intelligent, but without the facts of scales. For corn he reports no appreciable gain, but for years of very severe drought a gain of 30 to 50 per cent. For wheat a slight gain is reported. For other crops, interesting particulars regarding quality, root development, etc. Timothy is reported decidedly poorer in quality on subsoiled ground.

The Wisconsin Agricultural College tried subsoiling and got larger yields on subsoiled plats in dry years and less in wet years, averaging for four years 51.3 bushels for soil plowed five inches deep, and 55.2 bushels of corn for soil subsoiled 18 inches deep. Time from 1871 to 1874. This agrees with our results.

In the report of the National Department of Agriculture for 1869 a subsoil experiment of Mr. Gill of Illinois is reported, with a yield of 120 bushels to 40 in favor of subsoiling. The conditions accompanying this test are not stated, and its value as a trial cannot be well stated and it will have to pass as one of general and perhaps loose observation, indicative however of the views of Mr. Gill, after experience.

The same report quotes an accurate trial with potatoes by the Pennsylvania Central Experiment Farm, which is connected with the Agricultural College. Six plats were involved, and the yield was as 221.46 bushels per acre are to 131.79 bushels per acre in favor of subsoiling. The character of the season, 1869, is not stated.

From the same source, a trial by Mr. Davison of Georgia for cotton is given, with weights. Subsoiled cotton per acre being 630 pounds, and un-subsoiled 380 pounds. The first plat was No. 1, and the last No. 28

of a series, being too far apart for conclusive results, yet a part of general evidence on this question. The season is reported as one of long continued drought. The same report also gives the results of a Russian experiment-farm with sugar beets. Results in favor of subsoiling, as 82 measures are to 190 measures, the latter being the richer in sugar, also.

Prof. E. M. Shelton, of the Kansas Agricultural College, reports three plats subsoiled for corn versus three un-subsoiled, for the season 1882. Yield, subsoiled 40.2 bushels and for un-subsoiled 37.7 bushels; for 1883 the yield was reversed and stood 50.57 subsoiled and 54.38 un-subsoiled, with fodder as 148 is to 166 pounds, for plat. In 1884 results stood 64.1 bushels for subsoiling and 62.1 for un-subsoiled. This subsoiling was but four inches below a 6½ inch furrow, while the trials here were eight inches below a seven inch furrow. Average for three years, 51.6 bushels for subsoiled and 51.4 bushels for un-subsoiled.

Prof. I. P. Roberts, of Cornell Universily, reports for 1877–8 a trial with wheat—results: subsoiled ground yielded 16 bushels and 32 pounds, and the un-subsoiled gave 22 bushels and 16 pounds. He offers no explanation of the result. Ground clayey, and winter a severe one.

The average of two years trial with oats gave for subsoiled section 46 bushels and 19 pounds, for un-subsoiled section 48 bushels and 33 pounds. The average yield of corn for the various trials recorded is for subsoiling 55.7 bushels per acre; for unsubsoiled section 53.8 bushels per acre.

The careful trials recorded herein do not show the results that have been claimed for subsoiling, and do not give an encouraging balance sheet. If the dry season could be foretold a happy result would follow, unless the soil becomes unfitted for the next succeeding wet season.

I should have observed, before, that the subsoil of our Missouri Farm is compact, hence those owning soils with open subsoils must not assume from the trials here that subsoiling for them in dry seasons, will be advantageous.

SUGGESTIONS.

(1) It seems satisfactorily shown that the breaking up of the compact subsoil of this Farm increases its water holding capacity, both in years of drought and in wet seasons.

As our subsoil is representative of most of the soils of the State, it may be inferred that like results will follow on most of the farms of the State, and that general subsoiling would materially diminish the rapid rising of our creeks after heavy showers so characteristic of our section, and would diminish surface washing of soil to some extent.

(2) That the breaking up of the compact subsoil will increase the feeding area of our plants, is not by any means so clear.

Modern researches have shown that the great bulk of roots grow in the surface soil. Dr. Sturtevant found almost all of the roots of corn in the first four inches and probably not 1–1000th below this area, and on close investigation concluded that the deeper running roots were water feeding roots and designed as such. Prof. Voelker, of world wide fame, found that even the deepest rooted of our common farm crops, clover, developed 3½ tons of its roots in the first six inches of the soil, while the second six inches of soil contained only scattering, fine fibres, and in the third six inches the fibres could not be traced.

Near the sun and air amid the organic matter of the "agricultural," or upper soil, seems to be the home of the feeding roots of our ordinary cultivated plants, to induce them to go lower is to develop them in an unnatural area.

So far as the experiments related go, they seem to show that the only good derived by subsoiling came from the increased storage of water, that carried the plants over a drought, in case no drought occurs this water is injurious for the soil tested. If we are to avail ourselves of the fertility of the subsoil it looks as though some other method than subsoiling would have to be resorted to.

Respectfully submitted,

J. W. SANBORN.

PRIMITIVE ORIGIN OF SOILS.*

By J. W. Spencer, Ph. D., F. G. S.

Prof. of Geology, University of Missouri.

Do plants need soil in order to live and flourish? If by soil is understood only the medium in which to live, the answer would be—No. They can be made to thrive in water, cotton, wool, clean sand and other substances, provided proper food be furnished to them. In ordinary conversation we speak of soil as not only the medium for plants to live in, but also that from what they obtain food.

Besides water and carbonic acid, which are obtained from the atmosphere, plants need potash, magnesia, iron, phosphoric acid, sulphuric acid, nitrogen, and to some extent although not usually, soda, chlorine and silica.

Nitrogen is one of the gases of the air, but plants obtain this element mostly through decomposing animal or vegetable matter. Chlorine, soda and silica are not often lacking in soils which contain the other ingredients. Magnesia is usually present when there is plenty of lime. Of iron and sulphur there is not often a scarcity. Consequently one needs only to specialize those compounds in nature required to furnish the different media in which to grow, and such as supply the potash, phosphate and lime food. The quantity of these substances in plants is small, and the question may be asked: What is their use? In all cases, the answer cannot be given. The importance of iron to plants somewhat resembles its utility in the blood, for without it, leaves lose their deep green color, and pine away, not being able to assimilate such food as they obtain from the air.

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* An illustrated lecture delivered before the Farmers' Institute, at Jackson, Missouri, February, 1885.

The use of potash aids the plants to convert their food into starch. In the form of lye, all of you are familiar with potash in one of its combinations, and in this paper I will have a great deal to say about it, as well as other substances whose direct use to plants belongs to the department of my friend Prof. Sanborn, but to my department falls the duty of telling you how the soils are made, and where the mineral food comes from.

The greater proportion of the soils of the earth's surface is underlaid by rocks regularly stratified like the leaves of a book, and resting in a more or less horizontal position. The most common of these rocks are limestones, shales and sandstones—either alone or interbedded. The materials out of which all of these rocks are made, are of secondary origin and, indeed, many have doubtless been worked over several times.

Beneath these stratified rocks, everywhere over the globe, rest in irregular layers or masses, highly crystalline rocks, showing the previous effects upon them of great heat, pressure and moisture. Amongst the commonest of these rocks are granites, syenites, porphyries, traps, etc., such as the specimens which will be shown you as we proceed.

The granite is composed of quartz, feldspar and mica, of which these are examples. [Specimens exhibited.]

The next specimen is a piece of coarse granite, whose components are in large fragments; the glossy green mineral being quartz; the shining scales, mica; and those particles with smooth surfaces, feldspar. Here again we have two finer-grained specimens of granite, one being gray the other red, which come from Madison county.

The quartz is silica, and can be crushed into sand; the feldspar is composed of clay, to which is added, in nature, much potash and sometimes soda.

The same elements, together with iron and sometimes other substances, make up the mica. Some varieties of granite have the mica replaced by hornblende, as in this rock to which lime, magnesia and iron have been added.

Another class of ancient rock is illustrated by this, dolerite or trap, which has been a melted rock in some old volcano. It contains much less sand than the former, as well as potash, but it is rich in lime, magnesia, iron, soda and some clay.

It is from these and similar rocks that have been formed, directly or indirectly, all the harder rocks of the earth's crust, which throughout the great Mississippi valley rest piled up like a heap of books.

The depth to which these crystalline rocks are buried, varies greatly. There are places in the Alleghany and Rocky Mountains where they are covered to a depth of many miles. At St. Louis they have been reached at a depth of 3,800 feet. In the eastern part of this county (Cape Girardeau), they are about 3,700 feet beneath the surface, whilst further westward, they are not more than 1,300 feet beneath the soil, along the county line and in Madison county and some adjacent counties, these very ancient rocks actually come to the surface.

It may reasonably be asked how could our more recent rocks and soils be formed from these crystalline and hard rocks which are now so deeply buried.

The deeply buried condition did not always exist. In the earlier period of the earth's history, only a comparatively small portion of the American continent was above the sea, but that portion formed a a broad mountain chain, extending from Labrador to the Great Lakes, and thence northwestward to the Arctic Ocean. Besides the belt represented in bright red color on the map, there were islands in New York, Wisconsin, in the Iron Mountain region of this State, in Texas, and in some other regions. It was from the ruins of these mountains and islands, and from the materials of the sea, that all the rest of the surface of our continent has been produced—making the sandstones, shales and limestones, such as you see along the beds or sides of the streams, and beneath the surface soil of your farms.

Let us consider the manner in which these newer rocks were formed, for they are often only soils hardened again into rocks, and a study of their origin is a study of the methods by which some of the modern soils have themselves been produced.

All of us know that the atmosphere is composed of 79 per cent. of nitrogen, and about 21 per cent. of oxygen. Besides these elements, there is a very small proportion of another gas called carbonic acid, of which there is one part present in every 2,500 parts of the air. It is one of the most important although slow-working agents, in not only the production of soils, but also in the production of plant-food. It has always been a component of the atmosphere, and in former times it appears to have been more abundant that at present.

As plants derive nearly all their carbon from this gas, enormous quantities are being constantly taken from the air and stored up. On the other hand, this loss is being diminished by the decay and combustion of vegetable and animal matter, and also by the respiration of animals. Thus, if this candle be burned in a confined volume of air, as in a bottle, the flame soon becomes extinguished, and if we pour into the bottle some lime water, the water becomes muddy from the presence of the gas produced by the burning of the candle. Again, if I breath into this vessel of lime water, the water will again become muddy, because at every breath some carbonic acid escapes from my lungs. This gas is soluble in water, and consequently some of it gets washed down by every rain storm. Also, decaying organic matter supplies additional quantities of the gas to streams. All natural waters contain it.

Into this flask is poured some pure water in which is placed powdered limestone. If this mixture be shaken and then allowed to settle until the water is clear, or what amounts to the same thing, allowed to pass through a piece of porous filtering paper, and then have added to it some of this clear solution of ammonic oxalate, no mud or precipitate will be produced, showing that the water is free from lime.

If now, through the same water containing broken limestone, carbonic acid gas (which is being generated in this flask) be made to flow for a few moments, and the mixture be then allowed to settle, or if it be filtered, we have again a clear solution. Now, if the ammonic oxalate be added, the water becomes muddy, because lime has been dissolved by the gas.

If the specimen of limestone which is in my hand be examined, it will be seen that it has been riddled, by the action of water containing carbonic acid running through the original cracks or crevices. It is thus that caverns are produced in limestones by the great power of this gas, although the action is slow.

Besides this action constantly going on in nature, dissolving limestone, we find that carbonic acid is also dissolving the potash, soda, magnesia, lime, iron, etc., out of hard crystalline rocks, such as granites and traps, all of which could be shown had we many hours to spend over these experiments.

Nearly all the potash in our soil comes directly or indirectly in this manner from granite, two of whose component minerals contain it —these are the feldspar and the mica. All of us are familiar with the potash in wood ashes, the ashes being simply the mineral food of plants, taken from the soil, the same as our bones are derived from the mineral portion of our food.

The crystalline rocks are very hard, as we can here see, but the water containing carbonic acid does, in nature on the grandest scale, what we may imitate in the laboratory. They dissolve some of the alkalies from these hard rocks and leave them porous, to be further broken up by water and frost into soil, or to be washed down by the rains and streams to furnish mud to the rivers. I wish you to observe this very interesting specimen of decayed granite, which, although once as hard as these other specimens, is now so disintegrated that it crumbles between one's fingers.

Here is an other specimen of solid, reddish porphyry, composed mostly of feldspar. It is hard and exceedingly tough. But beside of it there is another piece covered more or less with a white powder—a pure clay called kaolin—which has resulted from long exposure to weather in a neighboring country. It is the result of the action of our friend—carbonic acid. Yet were we to use the stone for building purpurposes, we should be compelled to call the gas our enemy.

The oxygen of the air is also another agent in breaking up rocks, particularly those which contain iron, as in this specimen of greenstone. The crystalline rocks are often decayed to a very great depth. In the Iron mountain region such rocks are sometimes decayed to a depth of seventy-five or eighty feet, and I have heard of other regions in other countries where the decay reaches to the enormous depth of 250 feet from the surface.

Where such rocks are at the surface of the country, the soils will be made up of their decomposed and broken remains. At least such is true in countries south of this latitude, and indeed somewhat north of it., although in Wisconsin, New York and Canada it is not often the case.

We have now arrived at the stage in rock decay when mechanical action of running water plays a most important part. The rains and streams wash out of crystalline rocks an enormous quantity of potash, soda, lime, magnesia, etc., which are eventually carried to the sea in a state of solution. The waters from the rains soon accumulate into rills, which wash down the loose rocks left by atmosheric decay and make the rivers muddy.

These running waters afterwards deposit a portion of the mud along the flats of the river valleys, and carry off the remainder to fill up some marsh, lake or arm of the sea; and in this way much of the continent has been gradually built up from the ruins of pre-existing highlands.

Some muddy waters settle and become clear much more quickly than others. This depends upon the fineness and the nature of the material. I will here put into a bottle, first some sand and water. We can all see that the sand settles very quickly, Next, let us add some broken granite. The water does not now become clear so soon. Then, if very fine clay, made out of wholly decomposed granite, be shaken in the bottle of water, it will not become clear for a long time. As long as the vessels are shaken these various muds will not settle; nor will a little shaking prevent some of the coarse materials separating from the water. This is what happens in a river, or in the gentle waves of a sea or a lake. Flowing waters have the power of assorting different kinds of mud. Thus it is that beds both of sandstones and of shales, are produced—the former in one locality, the latter in another—for these rocks are only hardened sand and clay. Very often different kinds of rocks are not pure, but contain an amount of another kind of stone, or some foreign substance.

The amount of sand, clay and broken fragments of other rocks, which is being carried down the Mississippi river into the Gulf of Mexico every year, is enormous, and amounts to over 400,000,000 tons, all of which is being deposited, to make new beds of sandstones and of shales. It was by the destructive action of running waters that the great, broad valley of the Mississippi river, with bottom plains in front of this county having a width of five miles, was made, as well as the smallest ravine about any of your homes.

The origin of limestones is very different from that of other rocks. With hardly any exceptions, they are formed from the remains of marine animals. Here we see a shell in this piece of stone, another specimen is made up of coral, and a third is full of fragments of crinoids. Again we find a piece of modern limestone composed of broken shells, such as is being now produced off the Florida coast, and another, which was produced in this State ages ago, when the continent was covered with a shallow sea. Although the shells are not always visible in the limestones yet it does not alter the truth of the statement that such rocks are derived from animal remains. In fact, three-fourths of the rocks of this State, above the crystalline formations, are composed of limestones of some kind or another, derived from sea water through the intervention of animal life. But this loss of lime and also of magnesia to the sea is restored by the rivers taking back limestone dissolved in water, as we have seen, by the aid of carbonic acid. Every year the Mississippi river carries into the Gulf of Mexico about two and a half million tons in solution, of which about one-half is limestone. This is enough to create twenty billion mussel shells like this one from our streams, which we all are familiar with.

Subsequent to the making of the sandstones, shells and limestones, beneath the waters of the sea, these formations have slowly been lifted up far above the ocean level; and in the Rocky Mountains the rocks are found to contain shells, even at the height of 14,000 or 16,000 feet, thus showing an enormous elevation of the ancient sea bottoms, although this elevating process was gradual..

With regard to the rocks underlying the western portion of your county, they are very ancient, and were deposited in a shallow sea around those ancient islands now represented by Pilot Knob, and other portions of the Ozark ridge. The eastern part of the county is more recent. The rocks of St. Louis are newer, and those of Northwest Missouri are still more recent, but all are very old. In fact, as to antiquity, no State can boast of older lands, and very few of as ancient deposits.

We now see that the surface of our continent beneath the soil is underlaid by a variety of rocks, from the granites, etc.. of Canada, and of the Pilot Knob region, to limestones, sandstones, and clays of this county, and that from the decay of these materials we get the mineral matter of our soils, directly or indirectly.

The vegetable matter in the soils is of importance. As for giving up carbonaceous matter to the plants, it is of much less value than for collecting and supplying nitrogen in the form of ammonia. Whilst crops have largely to depend upon pre-existing organic matter for their ammonia, they could derive the whole of the carbon, etc., from the air. Besides accumulating ammonia in some form, plants in gathering up the ashes draw to the surface stores of potash, phosphates, lime and other substances, ready for absorption by the next growth.

When a soil is destitute of all animal or vegetable matter, but has all the mineral food that plants can use, and a suitable climate, it will accumulate in the course of years a new supply of vegetable remains, begun perhaps by a few solitary weeds. Of course, for thrifty growth, and for making the ground more absorbtive, a vegetable mold is needed. But this subject is outside the study of the primitive origin of soil.

Some may ask: "What has all that we have learned, to do with agriculture?" In reply, it has borne on the study of how the productive soil is made. The character of your farms depends directly upon the mineral constituents, and the mode of geological deposition of your soils; and it is necessary to lay an intelligent foundation for further study. It will not give those benefits, of which Nature has deprived you, but it can give a knowledge of Nature's processes, and when properly studied, may aid in the selecting of the most favored spots, or in improving or keeping what you already have; or, if your soil be deficient in something absolutely necessary for the growth of crops, your knowledge will enable you to supply the necessary ingredients.

Soils are formed in several ways:

1. They are formed from subjacent rocks, as has already been partly illustrated in the case of the decayed granites, and depend upon their characteristics. Thus if we see the prevalence of certain rocks in a region, we can often know what is to be expected of the soil. If we find pebbles of limestone or of feldspar, we may conclude that the

one soil has plenty of lime and the other plenty of potash, for the fine soil usually partakes of the nature of the stones which it contains. Whilst such are favorable indications, unfavorable indications are as readily seen. Thus, if the rock contains many cherty or flinty fragments, so will the soil derived from it, which we may all see a few miles to the northwestward of this county.

Soils produced from granites may be either poor or rich. They are apt to be more or less sandy, but this is not always the cause of such being poor. It sometimes happens that the feldspars, in the more exposed rocks of the surface, have lost nearly all their potash, by rain-water washing it out, and such consequently form poor soils. In the rich granite soil, there is much broken-up and only partly decomposed feldspar, which will yield an abundance of potash. I have here in this bottle some sand that would produce an excellent soil because it is very largely composed of broken feldspar, but in course of time, and especially under cultivation and action of frost, it would become more or less clayey.

Many of us know the necessity of having phosphate of lime (the component of bones) in our soil. The usual name is apatite, and without apatite, plants will not thrive. Of this mineral here is a beautiful crystal. Its primary source is in granitic and some other crystalline rocks.

Sulphur, in the form of iron pyrites, like this specimen, is usually present in these rocks. So we see that soils derived from crystalline rocks (including those containing lime) may hold all the mineral food requisite for good crops, but sometimes the valuable substances have been worked out by rain-water.

Sandstones, like these specimen, have often their component grains cemented together by particles of limestone matter, and consequently are easily broken up by the action of the weather, producing sandy soils, as well as the assorted sand from decomposed granite. The presence of calcareous matter in this sandstone is shown by putting upon it some strong acid, when the liquid effervesces, or boils up. Such a sandstone as this next specimen, which is nearly pure, would produce a barren soil, as it is free from calcareous matter, from even enough clay to prevent it from being blown around by the wind, and from any alkalies. After all, sandy soil which is of value depends upon the presence of a considerable amount of clay, or broken rocks of other material, containing the valuable minerals, and of sufficient consistency to retain some moisture. I have seen sandy ground after one or two crops become a perfect barren, and drifted about by the wind into banks, as if it were so much snow. This would not have been the case had there been even a small per cent. of clay present.

Clays are not only produced from the washings of crystalline rocks as we have seen, but may be derived directly from the weathering of shaly beds, which have themselves come originally from the most ancient rocks. Such clays sometimes contain free sand and undecomposed feldspar, but usually, not as much as the clays brought down more directly from the granites.

The shales often contain some fossil shells or even a considerable quantity of limestone matter, and then the soils may be quite rich, as many of the richer soils have been made from mixtures of broken up limestone and shale. When these clays contain enough sand to make them loamy, the advantage is great.

Limestone rocks produce calcareous soils. Among the valuable materials from the ancient shells, they have derived, in many cases, phosphates from some of the marine organisms. Then the coral and the crayfish contain some phosphate, and when their remains are enclosed in the limestones, and these become soils, they furnish this useful food to plants. Here again we have a second source of phosphates for soils. The great bulk of our limestones, no matter how hard, usually contain some shale, and very many others contain remains of animal and vegetable organic matter, even enough to give them a dark color. Very often the flinty or cherty stones occurring in soils, are derived from beds of limestones and not from sandstones. I have seen beds of limestone nearly half filled with chert for a depth of many feet. In many cases these flinty beds have been derived from some marine animals, such as sponges. The soil, although not poor amongst these flints, is too scarce for many agricultural purposes.

Soils of valleys arise from the rains and streams washing down the mud and best materials from pre-existing soils, such as we have been speaking about, and from others to be mentioned later. The power of running water to carry a load depends upon its velocity, and by the current being slightly diminished its load of earth is soon deposited. If we reduce the velocity of the stream by one-half, it will carry only one sixty-fourth part of its previous load. Thus we can easily see that when the streams leave the hillsides, they will naturally deposit much mud in the river bottom, unless the current be very great. Many of the bottoms of our smaller valleys have thus been filled up to a depth of twenty-five or fifty feet, or perhaps five times that depth in the great valleys. The old valley of the Mississippi, at New Madrid, is filled with mud for a depth of 192 feet.

If many poor lands could only be mixed with other kinds of poor land an abundance of wealth would frequently result. Now rains and streams have very often made such mixtures when they have carried down the mud and sand from the hillsides to fill up the bottoms of the valleys, although the rivers sometimes re-assort and carry the best materials away.

Water has the power of dissolving out more potash from the soil of the higher lands than from the lower, as rapid running motion is a much more powerful agent in removing this useful substance than either standing water or waters moving slowly over the lower lands. Again, the streams carry off much vegetable matter from the higher grounds, which being enclosed in the alluvial deposits of the bottom lands, gives up to them a relatively large amount of mineral food (potash, phosphate, etc).

I will now proceed to *another class of soils*, which is of different origin, although, of course, derived from the same rocks. This class may properly be divided into two sections—the Drift soil and the Loess. Of the former kind, we are south of its limit, although its margin is somewhere between St. Louis and this country. In the geological period preceding our epoch, much of North America was submerged beneath the surface of a sea or gigantic lake, during a very cold time; when even Missouri was as cold as Southern Greenland is to-day. During this time, great quantities of ice drifted southward, and brought enormous loads of stones and sands, not only from our Northern States, but also from Canada. During that time all the natural soil made from the decomposed granite and other crystalline rocks of Canada was swept southward.

As we now possess the ancient Canadian soil, that is the reason I told you that the crystalline rocks of the North are not now decomposed to any depth, for the transportation was sufficiently recent not to afford time for the northern hills to get decayed to any great depth again. The northern mud and stones became mixed with local material to form stoney under-clays, which we call Drift. Such clays, at Columbia, are thirty feet or more in depth in some places. Subsequent to the transportation of the northern materials by ice, some of them have been assorted by the waves of the sea or lake into which they were dropped, and now form the surface soil of much of Northern Missouri and the country to the northward.

These deposits, which are called Loess, are somewhat related to the last, but overlie them.

They are more confined to the immediate vicinity of the greater rivers. The Loess is absent from the north, and often from our higher ground. The origin of these deposits is not quite understood. They appear to have been made in quiet water, at a time when the continent was at a lower level, and the back-water of the Mississippi filled the whole of its own valley, and backed up into the valleys of its tributaries, and even covered some of the hills.

The Loess is that light colored, pure, stratified deposit, such as is exposed along the bluffs of the Mississippi, and covers much of this county. It is a fine clay, containing sand, with more or less lime. It often contains fresh-water shells. These deposits usually make rich soils, and to them many of you owe the value of your farms. This portion of Missouri is one of the most interesting to geologists, of all the counties in this State. In your soils you have every variety, from the many kinds derived from subjacent rocks without the agency of lakes or rivers, to the rich Loess and others formed on the bottom lands by moving water.

I have omitted, intentionally, speaking of the relation of various soils to different kinds of plants, and many other problems belonging to agriculture which might be here introduced. But in its place I have endeavored to point out the geological origin of the mineral wealth of your soils, derived from the varied sources, since the earth was in an undeveloped, chaotic condition, through the ages down to the present time—a subject to me always most attractive.

DRAINAGE AT BONNIE BLUE FARM.

A. B. Matthews.

The diagram on page 396 represents an eighty acre field that has been thoroughly drained during the past summer of 1885. This field is part of the *Bonnie Blue Angus Stock Farm*, at Little Blue depot, on the Missouri Pacific railroad, Jackson county, Mo.

Let us enter into a few interesting and instructive details regarding this plat of land, and we will find in it a vast field for education to the Missouri farmer and agriculturalists in general. First, we will draw comparison as to what it has beeen in the past, and what it is to-day. We will go no farther back than the year 1882, so that we may rely on recent and trustworthy information.

In that year the eighty acres referred to were sold for ten dollars an acre, realizing $800. In the following year there were some willow patches grubbed; to that a few blind ditches were added and one-quarter mile of board fencing built; with these trifling improvements it was re sold at an advance of four dollars an acre—that was in the year 1883. At that date there were but seventeen acres fit for cultivation, which were rented at two dollars per acre; after plowing, sowing and planting, the crop proved a complete failure from wet, so the tenant had no return whatever for his summer's labor.

In 1884 the eighty acres became my property. Twenty-five acres were let that season at $2.50 per acre; the crop was wretched, not paying for seed and labor. As I was receiving no interest for my capital, I resolved to have the land thoroughly drained. To do this scientifically, I had the levels accurately taken by a competent engineer, Mr. P. H. Gunter, whose survey has given perfect satisfaction. My drai contractor, Mr. G. M. Sterne, was also a complete master of his work, so that the entire results on my outlay have been most satisfactory.

Owing to the great rainfall in spring, and the heavy flow of water from the bluffs on the east side of the eighty acres, I was prevented from commencing work as early as I wished. So wet was this field that I may mention that two-thirds of it was entirely submerged on the first of April. This excess of water greatly retarded the work, not only of the drainage, but also of the cultivation and cropping; indeed, I had to drain a large portion during the summer, after the crops had been put in the ground. There was no alternative left; I had either to do that or lose my crop.

Planting corn was commenced on the 23d of May. The upper part of the field was thoroughly dry, but the lower part, next the Missouri Pacific railroad, was yet undrained, and was not finished until after the corn was shocked. I planted from east to west on the north part of the field, including in the strip about thirty acres. The other portion of the field was the last improved, consequently the last cropped as well as drained. Some fifteen acres of this portion had to be grubbed and cleared of willows from five to ten feet in height, the result of one year's growth. This piece was sown principally in broad-cast corn, at the rate of three bushels of seed per acre, the results of both experiments proving most satisfactory. The portion planted to corn has yielded forty-five bushels to the acre, which is considerably above the average of the district, even on the best cultivated, dry, rolling land. This to begin with, in one of the wettest seasons we have had for many a year, is most satisfactory, especially when it is kept in mind that only the upper, the poorest part of the field, was drained previous to planting; the lower or flat portion, the richest, being yet undrained.

So sanguine am I as to the results of another year's crop, that I have no doubt the fruits will reach from sixty to eighty bushels of corn per acre. The whole piece is now thoroughly drained and fit for any system of high farming and sub-soiling. In the other portion of the field —the south—the yield of fodder was marvelous. In the fifteen acres that were grubbed I am certain, from rough measurement, the crop is equal to twelve tons per acre of the most beautiful, bright corn-fodder that I ever saw, and which the cattle eat vigorously and thrive well on. The last portion that I sowed after drainage was on the 17th of July, and from that patch I reaped about six tons per acre. There is no mistake about the time of sowing, as my manager kept correct data.

What education our farmers can acquire on this eighty acre field, if they will only draw the contrast between what it was five months ago, and what it is to-day! Five months ago it was a willow and brush swamp that could not be crossed on horseback, actually in its primeval state and worthless. To-day, after thorough drainage, it becomes all at once fruitful land, bringing forth abundantly. In 1882, it was sold for $10.00 per acre, but yielded actually nothing; three years later, *tiles* have made it, verily, a Garden of Eden, and raised it in value from $10.00 to $80.00 per acre, and I am not certain that even at that price I could be tempted to exchange it. Only a year ago it was a huge malarial swamp; to-day it is turned over by the plow, dry and healthy, and the frosty air has moulded down the soil till it is now as mellow and friable as can be desired.

The tiles used for the leading drains were six inches in diameter, costing $5.00 per thousand. Those used for the ordinary drainage were three inches, but after this year's experience I would prefer even four-inch tile when the flow of water is great.

In addition to drainage, I cut a ditch outside the field to the east, so as to catch all surface-water shed from the bluffs. I found this absolutely necessary, as the field became so flooded at times that it was impossible for the drains to contain the water; now the water from the high land is kept outside the enclosure, and run by an open ditch into the Little Blue creek.

Where the land is steep I would recommend in addition to the ordinary drainage, water-furrows, intersecting the field at different points where most necessary; they prevent that accumulation of water and accelerated velocity which at times wash into the ditches, enormous quantities of soil; and let me advise those who intend trying drainage, always to err on the safe side, by draining close. Before laying the tiles great care should be taken to scoop out of the drain all crumbs of earth, leaving the bottom of the drain smooth, with a sufficient fall. The bottom of the drain should not be wider, if possible, than the outside diameter of the pipe; it is thus firmly kept in its place. It is also most desirable that a basin-shaped grating should guard the exit from the drain, to prevent rabbits or vermin entering. In ordinary leaders, it is a good plan to have a long wooden box made with an iron grating, or have drain pipes made, pierced full of small holes at both ends, taking special care that the openings between the gratings are equal to the discharge of the whole contents of the drain pipe, or they would form an obstruction to the water. It should be understood that no tree or hedge-row fence should be anywhere near a drain, as the roots will most certainly find out the drain and choke it.

There can be no specified rule laid down for the drainage of all lands, so much depends on the sub-soil; but we do know from experience that deep drains always run first and last, consequently render the land much drier than the shallow drains, by carrying away more water. There are cases where drains will not immediately act, where there is a hard crust or pan directly under the plow-sole, which requires breaking up by the sub soiler. In parks or wet lands full of coarse, tussocky grass, the drains will not act until the surface is broken up and re-sown, or relaid, so as to allow the surface to dry. Theoretically, one would say that in well drained land the water should descend to the drains; but practically, it is found that dense tenacious soils have not the power to transmit water as quickly as it often falls from the clouds, especially where the fall is considerable and the surface smooth, fine or caked. In fact, in dry weather, when the surface is cracked and the incline great, a hasty thunder-storm will rush over the cracks, the momentum of the water overcoming its gravity. In heavy clays and black adobe soils—sometimes called *sticky* in Missouri—there is a great tendency to contraction when dry, and expansion when wet. The surface of my drained land is exceedingly friable since drainage, still it ranks with the class of strong, tenacious, black soils.

The conflicting opinions as to what is perfect drainage, convince me that practice without theory is dangerous, uncertain and expensive; so, as I have had a season's experience on drainage, I am bold enough to give you my opinion as to what I consider to be the true theory of perfect drainage, confining my views to what is practical in this particular section of the country, and it may meet with the requirements of others.

1st.—That in perfect drainage, twelve hours rain should percolate and leave the land in less than fifteen hours from the time the drains begin to act, the difference in time being equivalent to the proportion of water the earth chooses to retain for its use, by capillary attraction.

2nd.—That the continuance of water in the soil longer than it would remain by capillary retention, is injurious, both chemically and mechanically, causing inequality in density of the soil.

3rd.—That the form of the drain should be deep and narrow, as affording the greatest area of porosity at the smallest cost, increasing the quantity of porous earth available to roots—nothing, animal or vegetable, can exist in dense undrained sub-soils.

4th.—That where pipes are used their material should be durable but porous; the object being to get a large area of porosity.

5th.—It will always be found that the passage of water in a pipe is quicker than its percolation through the earth or material of the pipe.

6th.—That the deeper the drainage the better the crops, and in no case should any portion of the drain be nearer to the surface than thirty inches.

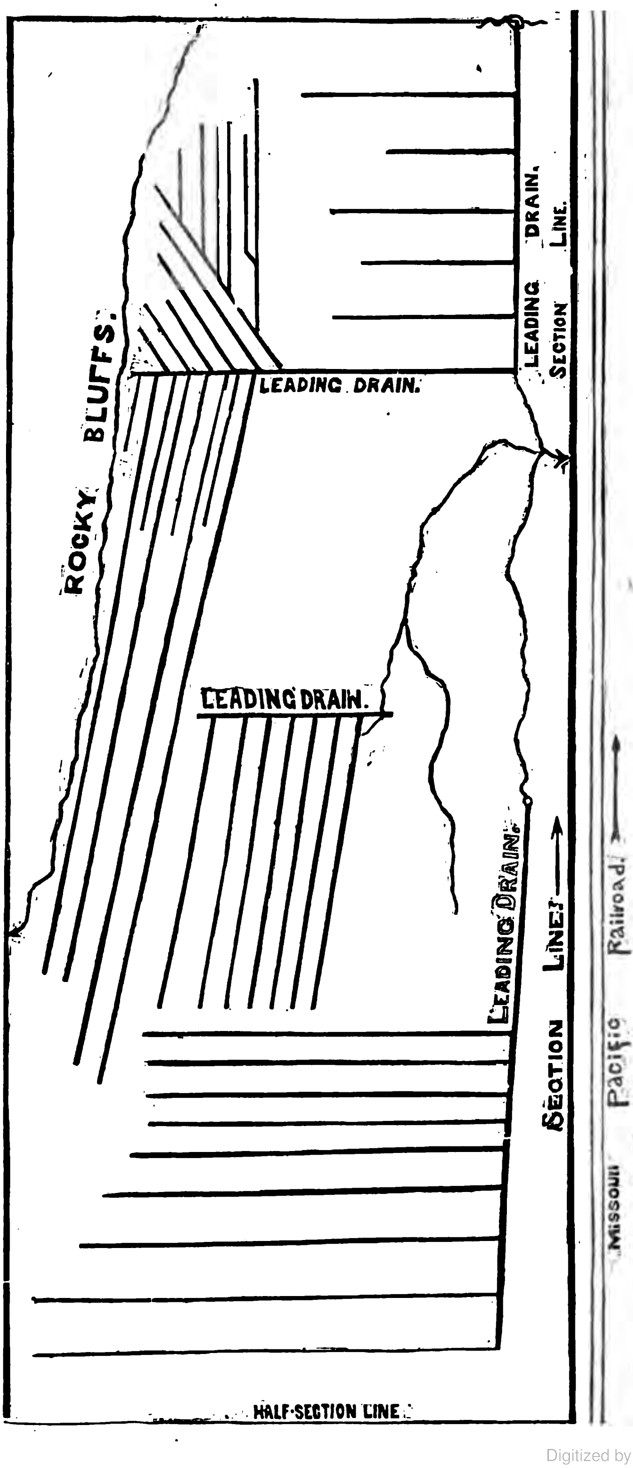
7th.—Drains should never be more than half full of water, the other half air. In this way the superior weight of water causes proper filtration, by displacement of air and replacement by water, by quick passage.

8th.—Shallow drains want a greater area of porosity than deeper ones, because the deeper the drain, the greater the weight and column of water. Consequently, the greater the pressure the more rapid the filtration; filtration at two feet will be double that at one foot, at four feet four times as great, and so on in proportion to the superincumbent weight of water pressing equally on all sides towards the drain. It is on this principle that deep pipe drains act quicker, and lay dry a greater extent of ground than shallow ones.

The influence of drainage on the quantity and quality of the food of the people as well as of stock is, over a large area, immense; but still non-drainage is the rule, and drainage the exception. In this respect there is a grand future for agricultural improvement. Land drainage was practiced in Essex and Suffolk—England—more than a hundred years ago. About fifty years after, our Scotch cousins took to it in earnest, and have connected deep cultivation and sub-soiling with it, and in this respect are in advance of English agriculturists.

Honorable mention should be made of the names of Elkington, Smith of Deanston, Josiah Parkes, Bailey Denton and Clutterbuck, in connection with the science of drainage. To James Smith of Deanston, Scotland owes her drainage, deeper cultivation, and an early appreciation of the value of town sewage; his labors proving to the world that we are only on the threshold of agricultural perfection.

MAP SHOWING TILE DRAINAGE ON BONNIE BLUE ANGUS STOCK FARM, THE PROPERTY OF A. B. MATTHEWS.



F. BESTMAN, Eng., Jefferson City, Mo.

FLORA OF MISSOURI.

By S. M. Tracy.
State University, Columbia, Mo.

The following catalogue is, I believe, the first publication of any list of the plants of the State, excepting a "Partial Catalogue of the Plants of Illinois and Missouri," published by Mr. Geyer about 1842, which has long been out of print. The present catalogue was commenced more than five years ago, but the press of other important work has prevented its earlier publication. Even now there are doubtless many species which are not included as there are some sections of the State which I have been unable to visit, and from which I have found it impossible to obtain lists. The counties along the central part of the Southern boundary, and the extreme Northern and Northeastern portions of the State have not yet been carefully studied.

The sources from which this catalogue has been made are; the herbarium of the State University which includes valuable collections made by the State Geological Survey, Prof. Swallow, Dr. Pech of Louisiana, Mr. Geyer and Dr. Engelmann of St. Louis and others; the "Flora of Jackson County" and extensive notes from Frank Bush of Independence; notes and specimens from Prof. G. C. Broadhead of Pleasant Hill, Geo. W. Letterman of Allenton; Mrs. McCluney of Sedalia, and many others. I am indebted to Prof. Trelease of Washington University for access to the Riehl collection of Missouri plants, and to Mr. B. T. Galloway of Columbia, who has done the entire work of preparing the list of grasses, and has furnished notes upon many other plants. Free use has been made of the various published works of Dr. Gray, and the government reports of King and Wheeler. During the past twelve years I have visited many parts of the State, and have preserved a careful record of plants observed in the different localities. Nearly every plant named in the catalogue has been carefully examined by myself, and doubtful specimens have been referred to Dr. Gray, Vasey or other recognized authorities for verification. I have endeavored to make the list accurate and have not included species of whose presence here I was not fully satisfied.

The arrangement of the catalogue is made to conform to that of Bentham and Hooker, and the nomenclature to that of "Gray's Flora of North America," and "Gray's Manual" fifth edition. In giving localities I have, in most cases given the names of the counties where found, followed by the names of the person who collected the specimen now in the University herbarium, or reporting its presence. The catalogue contains the names of 123 orders with 1820 species and varieties.

From the present incomplete list it will readily be seen that the State has four well-defined botanical regions. First, river bottom lands extending along the entire length of the State on the East and through its central portion along the Missouri river, and its larger tributaries. Second, the swamp region of the Southeast. Third, the Ozark region, including the hilly and broken country which covers a large portion of the State South of the Missouri river. Fourth, the prairie region which includes a large portion of the State North of the Missouri river, together with the Northwestern portion of the part of the State South of the Missouri river. In the extreme Northwest, the flora assumes a character much resembling that which is typical of the Western plains. The constantly changing character of the flora of a newly settled country, makes it practically impossible to make a list which is complete in all its details, as new plants are yearly introduced, or are found in new localities driving out the earlier forms and producing constant changes. When the State was organized our hills and prairies produced an abundant growth of buffalo grass which soon gave place to the blue joint which is, in turn being driven out by the more valuable blue-grass. With cultivation came purslane, dandelion, lambs-quarter and hosts of other troublesome weeds from the East, and within the last ten years the prickly solanum has immigrated from the far West and now seems perfectly at home in the streets of St. Louis.

It is earnestly desired that the catalogue be made as complete as possible, and to this end botanists and all others are requested to send notes and specimens of plants not named in the present catalogue, or from new localities. All such specimens will be placed in the University herbarium, and duly acknowledged in future editions of the catalogue.

DECEMBER 31, 1885.

CATALOGUE.

RANUNCULACEÆ.

Crowfoot Family.

1. **Clematis** Fremonti, Watson. Virgin's Bower.
Franklin, Jefferson, Washington, (Letterman), St. Louis, (Eggert).

2. Pitcheri, Torr & Gray.
Bates and Jackson, (Bush), Boone, (Tracy), Harrison and Livingston, (Broadhead), Iron, (Galloway).

3. Viorna, L. Leather Flower.
Cass and Greene, (Broadhead), Greene, (Shepard).

4. Virginiana, L.
Boone, (Tracy), Cole and Eastward, (Broadhead), Mississippi, (Galloway), Pike, (Pech).

5. **Thalictrum** anemonoides, Michx. Meadow Rue.
Boone, (Tracy), Greene, (Shepard), St. Louis, (Geyer and Kellogg).

6. Cornuti, L. Tall Meadow Rue.
Boone, (Galloway.) Cass, (Engelmann.) Lincoln and Linn, (Broadhead), Pike, (Pech), St. Louis, (Murtfeldt).

7. dioicum, L. Early Meadow Rue.
Iron, (Broadhead).

8. purpurascens, L. Purple Meadow Rue.
Greene, (Shepard), Jackson, (Bush), Miller, ,(Winick), Pike, (Pech).

9. **Anemone** acutiloba, DC. Wind Flower.
Jefferson and St. Louis, (Letterman,) Stone, (Shepard).

10. cylindrica, Gray. Long-fruited Anemone.
Greene, (Shepard), Mercer, (Broadhead).

11. decapetala, L. Carolina Anemone.
Bates, Cass and Vernon and in Western Mo. only, (Broadhead), Greene, (Shepard), Rare in Jackson, (Bush).

12. dichotoma, L.
Jackson, (Bush), St. Louis, (Murtfeldt).

13. Hepatica, L. Liver-leaf.
Pike, (Pech), St. Louis, (Kellogg and Murtfeldt), Central and Eastern Missouri, (Broadhead).

14. nemorosa, L. Wind Flower.
Boone, (Tracy), Howard and Knox, (Broadhead), St. Louis, (Murtfeldt).

15. parviflora, Michx. Small-flowered Anemone.
Knox and along Mo. river, (Broadhead).

16. patens, L., var. Nuttalliana, Gray. Pasque Flower.
St. Louis, (Murtfeldt).

17. Virginiana, L. Virginian Anemone.
Boone, (Galloway), Cole, (Broadhead), Jackson, (Bush), Pike, (Pech) St. Louis, (Reihl).

18. Pennsylvanica, L. Pennsylvanian Anemone.
Boone, (Tracy), Warren, (Broadhead).

19. **Myosurus** minimus, L. Mouse-tail.
Jackson, (Bush), Miller, (Winick), Pike, (Pech), St. Louis, (Murtfeldt).

20. **Ranunculus** abortivus, L. Small-flowered Crowfoot.
Common.

21. var. micranthus, Gray.
Boone, (Galloway), Benton, (Swallow), Jackson, (Bush), Miller, (Winick) St. Louis, (Geyer).

22. *acris*, *L.*, Buttercup.
Chariton, (Swallow).

23. aquatilis, L., var. tricophyllus, Chaix. Water Crowfoot.
Adair, Jasper, St. Charles and Western Mo., (Broadhead), Pike, (Pech).

24. var. stagnatilis, DC.
Little Blue river, Jackson, (Bush).

25. fascicularis, Muhl. Early Crowfoot.
Jackson, (Bush), Pike, (Pech), St. Louis, (Geyer).

26. multifidus, Pursh. Yellow Water Crowfoot.
Jackson, (Bush), Pike, (Pech).

27. *muricatus, L.*,
Miller, (Winick).

28. Pennsylvanicus, L. Bristly Crowfoot
St. Louis, (Murtfeldt).

29. recurvatus, Poir. Hooked Crowfoot
Boone, (Tracy), Jackson, (Bush), Miller, (Winick), Pike, (Pech).

30. repens, L. Creeping Crowfoot.
Common everywhere.

31. rhomboideus, Goldie.
Greene, (Shepard).

32. sceleratus , L. Cursed Crowfoot.
Jackson, (Bush).

33. **Hydrastis** Canadensis, L. Yellow Puccoon.
Rich woods throughout the State, but nowhere abundant.

34. **Isopyrum** biternatum.
Boone, (Tracy), Jackson, (Bush), Jefferson and St. Louis, (Letterman), Western Mo., (Broadhead).

35. **Aquilegia** Canadensis, L. Columbine.
Common everywhere—A white, flowering variety common in Jackson, and a yellow in Buchanan—(Broadhead).

36. **Delphinium** azureum, Michx. Larkspur.
Common everywhere—A white flowering variety in Jackson—(Bush).

37. exaltatum, Ait. Tall Larkspur.
Lincoln, (Broadhead), Miller, (Winick).

38. tricorne, Michx. Dwarf Larkspur.
Common.

39. Ajacis, L.
Adv. along railroads—Jackson, (Bush).

40. **Actæa** alba, Bigel. White Baneberry.
Greene, (Shepard and Bush), St. Louis, (Murtfeldt).

41. spicata, L., var. rubra, Mx. Red Baneberry.
Boone, (Galloway), Iron, (Broadhead), Pike, (Pech).

42. **Cimicifuga** racemosa, Ell. Black Snakeroot.
Greene and Wright, (Bush), Iron and Wayne, (Letterman), St. Louis, (Murtfeldt).

43. **Nigella** Damascena, L.
Becoming spontaneous in Jackson, (Bush).

MAGNOLIACEÆ.

Magnolia Family.

44. **Magnolia** glauca, L. Sweet Bay.
Missouri, (Torr and Gray).

45. **Liriodendron** Tulipifera, L. Tulip Tree.
Butler and Southeast Mo. (Letterman), Mississippi, (Galloway.) Not found north of Madison, (Broadhead).

ANONACEÆ.

Custard Apple Family.

46. **Asimina** triloba, Dunal. Papaw.
Common everywhere.

MENISPERMACEÆ.

Moonseed Family.

47. **Calycocarpum** Lyoni, Nutt. Cupseed.
St. Louis. (Shepard).

48. **Cocculus** Carolinus, DC.
Barton, Cole, Vernon, (Broadhead).

49. **Menispermum** Canadense, L. Moonseed.
Common everywhere.

BERBERIDACEÆ.

Barberry Family.

50. **Caulophyllum** thalictroides, Michx. Blue Cohosh.
Green, (Shepard), Jefferson along the Meramec, (Letterman), Pike, (Pech).

51. **Podophyllum** peltatum, L. May Apple.
Common everywhere.

NYMPHEÆCEÆ.

Water-Lily Family.

52. **Brasenia** peltata, Pursh. Water-Shield.
Barton, (Broadhead), Perry, (Demetrio), Putnam, (Swallow).

53. **Nuphar** advena, Ait. Yellow Pond-Lily.
Barton, Iron and Western Mo. (Broadhead), Boone, (Tracy), Green, (Bush),

54. **Nymphæa** odorata, Ait. White Pond-Lily.
Barton, (Broadhead), Buchanan and Mississippi, (Galloway), Pike, (Pech).

55. tuberosa, Paine.
St. Louis, (Murtfeldt).

56. **Nelumbium** luteum, Willd. Chinquepin.
Boone, St. Louis, (Tracy), Buchanan and Cass, (Broadhead), Pike, (Pech), Jackson, (Bush), Pettis, (McCluney).

PAPAVERACEÆ.

Poppy Family.

57. **Papaver** *somniferum*, L. Common Poppy.
Spontaneous about gardens.
58. **Argemone** Mexicana, L. Prickly Poppy.
Boone, (Galloway), Jackson, (Bush), Knox and Ralls, (Broadhead), Pike, (Pech).
59. var. albiflora, D. C.
Jackson, (Bush).
60. **Stylophorum** diphyllum, Nutt. Celandine Poppy.
Jefferson and St. Louis, (Letterman), St. Charles, (Broadhead.)
61. **Sanguinaria** Canadensis, L. Bloodroot.
Common everywhere.

FUMARIACEÆ.

Fumitory Family.

62. **Dicentra** cucullaria, DC. Dutchman's Breeches.
Common everywhere.
63. Canadensis, DC. Squirrel Corn.
Boone, (Tracy).
64. **Corydalis** aurea, Willd. Golden Corydalis.
Boone, (Galloway), Cass, (Broadhead), Pike, (Pech), St. Louis, (Riehl).
65. var. occidentalis, Englm,
Miller, (Winick).
66. var. micrantha, Englm.
St. Louis. (Engelmann).
67. crystallina, Englm.
Cass, Livingston, Vernon, (Broadhead).
68. flavula, Raf.
Boone, (Tracy), Jackson, (Bush).

CRUCIFERÆ.

Mustard Family.

69. **Nasturtium** *Armoracia*, Fries. Horseradish.
Common in old gardens.

70. lacustre, Gray. Lake Cress.
Greene, (Shepard), Pike, (Pech).

71. limosum, Nutt.
Jackson, (Bush).

72. obtusum, Nutt.
Jackson, (Bush), St. Louis, (Murtfeldt).

73. *officinale*, R. Br. True Water Cress.
Adventive at Kansas City, (Bush).

74. palustre, DC. Marsh Cress.
Greene, (Shepard), Jackson, (Bush), Pike, (Pech), St. Louis, (Riehl).

75. var. hispidum, F. & M.
Jackson, rare. (Bush).

76. sessiliflorum, Nutt.
Jackson, (Bush).

77. sinuatum, Nutt.
Along rivers in woods. Jackson, (Bush), St. Louis, (Murtfeldt).

78. *sylvestre*, R. Br. Yellow Cress.
Pike, (Pech).

79. **Barbarea** vulgaris, R Br. Winter Cress.
Pike, (Pech.)

80. **Arabis** Canadensis L. Sickle Pod.
Common.

81. dentata, Torr. & Gray.
Jackson, (Bush).

82. hesperidoides, Gray.
Jackson, (Bush). Pike, (Pech).

83. hirsuta, Scop.
Boone, (Tracy), Pike, (Pech).

84. lævigata, DC.
Boone, (Tracy).

85. Ludoviciana, Meyer.
St. Louis, (Riehl & Murtfeldt).

86, lyrata, L.
Jefferson, (Letterman.)

87. patens. Sulliv.
Greene, (Shepard).

88. **Cardamine** hirsuta, L. Small Bitter Cress.
Boone, (Tracy), Cass, (Broadhead), Jackson, (Bush), Pike, (Pech), St. Louis (Geyer).

89. —var. sylvatica, Gray.
Jackson, (Bush).

90 rhomboidea, DC. Spring Cress.
Boone, (Tracy), Cass and Polk, (Broadhead), Pike, (Pech), St. Louis, (Riehl).

91. rotundifolia, Michx. Mountain Water Cress.
Greene, (Shepard).

92. **Dentaria** laciniata, Muhl. Pepperwort.
Common.

93. multifida, Muhl.
Knox, (Broadhead)

94.. **Leavenworthia** aurea, Torr.
"Missouri," (F. L. Harvey.)

95. Michauxii, Torr.
St. Louis and Franklin (Letterman).

96. **Silene** aurea, Nutt.
Greene, (Shepard).

97. **Vesicaria** Shortii, Torr. & Gray. Bladderpod.
Greene, (Broadhead).

98. **Draba** brachycarpa, Nutt.
Jackson, (Bush), St. Louis, (Geyer).

99. Caroliniana, Walt.
Boone, (Tracy), Cass, (Broadhead), Clay, (Bush), St. Louis, (Geyer & Letterman).

100. var. micrantha, Gray.
Jackson, (Bush), St. Louis, (Murtfeldt).

101. cuneifolia, Nutt.
Boone, (Tracy), Greene, (Shepard), St. Louis, (Letterman).

102. nemorosa, L.
Lewis, (Egeling).

103. verna, L. Whitlow Grass.
Boone, (Galloway).

104. **Hesperis** *matronalis*, L.
Nat. in Boone (Tracy).

105. **Sisymbrium** canescens, Nutt. Tansy Mustard.
Benton, (Swallow), Jackson, (Bush), Pike, (Pech), St. Louis, (Geyer & Murtfeldt).

106. *officinale*. Scop. Hedge Mustard.
Common.

107. *Thaliana*, Gaud. Mouse-ear Cress.
Boone, (Tracy).

108. **Erysimum** asperum, DC. Western Wall-flower.
(Torrey and Gray.)

109. var. Arkansanum, Nutt.
Franklin, Jefferson, St. Louis. (Letterman).

110. cheiranthoides, L. Wormseed Mustard.
(Torrey and Gray.)

111. **Thelypodium** pinnatifidum, Watson.
Jackson, (Bush).

112. **Camelina** *sativa*, Crantz. False Flax.
Cass, (Broadhead).

113. **Brassica** *alba*, Gray. White Mustard.
Boone, (Tracy), Jackson, (Bush), St. Louis, (Murtfeldt).

Campestris, L. Charlock.
Jackson, *in old fields*, (Bush).

115. *nigra*, Gray. Black Mustard.
Common everywhere.

116. *rapa*, L.
Jackson, *in old fields*, (Bnsh).

117. **Capsella** *Bursa-pastoris*, Mœnch. Shepherd's Purse.
Common everywhere.

118. **Lepidium** intermedium, Gray.
Jackson, (Bush).

119. *ruderale*, L.
Jackson, (Bush), Miller, (Winick), St. Louis, (Torrey and Gray).

120. Virginicum. Wild Pepper-grass.
Boone, (Tracy), Cass, (Broadhead), Jackson, (Bush), Pike, (Pech), St. Louis, (Geyer).

121. **Thlaspi** *arvense*, L. Pennycress.
Jackson, (Bush).

122. **Raphanus** *Raphanistrum*, L. Wild Radish.
Polk, (Broadhead).

CAPPARIDACEÆ.

Caper Family.

123. **Cleome** integrifolia, Torrey and Gray.
Clay, (Broadhead), Jackson, (Bush).

124. *pungens*, Willd.
Pettis. (McCluny,)

125. **Polanisia** graveolens, Raf.
Jackson, (Bush), St. Louis, (Murtfeldt).

CISTACEÆ,

Rock-Rose Family.

126. **Helianthemum** Canadense, Michx. Frost-weed.
Cass, (Broadhead), Greene, (Shepard), Pike, (Pech).
127. **Lechea** major, Michx. Pin-weed.
Greene, (Shepard).
128. minor, Lam.
Greene, (Shepard), Pike, (Pech), St. Louis, (Riehl), Southwest Missouri, (Broadhead).
129. tenuifolia, Mx.
Greene, (Shepard).
130. thymifolia, Pursh.
Pike, (Pech).

VIOLACEÆ.

Violet Family.

131. **Viola** blanda, Willd. White Violet.
Boone, (Tracy).
132. Canadensis, L.
Pike, (Pech).
133. canina, L. var. sylvestris, Reg. Early Blue Violet.
Greene and Knox, (Broadhead), Pike, (Pech).
134. cucullata, Ait. Blue Violet.
Common everywhere.
135. var. cordata, Gray.
Boone, (Tracy) Pike, (Pech), St. Louis, (Geyer).
136. var. palmata, Gray.
Common everywhere.
137. delphinifolia, Nutt.
Common everywhere.
138. hastata, Michx.
Pike, (Pech), Boone, (Galloway).
139. lanceolata, L.
Livingston, (Broadhead).
140. pedata, L. Bird's-foot Violet.
Common everywhere.
141. var. bicolor.
Boone, (Tracy), Greene, (Shepard), St. Charles, (Broadhead), St. Louis, (Murtfeldt).

142. primulæfolia, L.
Jackson, (Bush), St. Louis, (Tracy).

143. pubescens, Ait.
. Common everywhere.

144. rostrata, Pursh.
Miller, (Winick).

145. rotundifolia, Michx. Round-Leaved Violet.
Boone, (Tracy).

146. sagittata, Ait. Arrow-leaved Violet.
Common everywhere.

147. striata, Ait.
Common everywhere.

148. *tricolor*, L.
Cass, (Broadhead), Pike (Pech), *escaped.*

149. var. arvensis.
Boone, (Tracy), Jackson, (Bush), St. Louis, (Murtfeldt).

150. **Ionidium** concolor, Benth. & Hook. Green Violet.
Common in rich woods.

POLYGALACEÆ.

Milkwort Family.

151. **Polygala** ambigua, Nutt. Milkwort.
Jackson, *not common*, (Bush).

152. incarnata, L.
Cass, (Broadhead,) Greene, (Shepard), Jackson, (Bush), Pettis, (McCluny.)

153. Nuttallii, Torr. & Gray.
S. W. Missouri, (Broadhead).

154. sanguinea, L.
Greene, (Bush & Shepard).

155. Senega, L. Seneca Snake Root.
Boone, (Tracy), Greene, (Shepard).

156. verticillata, L.
Boone, (Galloway), Greene, (Shepard,) Jackson(Bush), Pike,' (Pech), St. Louis, (Riehl).

CARYOPHYLLACEÆ.

Pink Family.

157. **Saponaria** *officinalis*, L. Bouncing Bet.
Common about old gardens.

158. **Silene** antirrhina, L. Sleepy Catchfly.
Jackson, (Bush), Miller, (Winick), Pike, (Pech), St. Louis, (Riehl).

159. *noctiflora*, L. Night-flowering Catchfly.
St. Louis, (Murtfeldt).

160. regia, Sims. Royal Catchfly.
Common in Southern Missouri.

161. stellata. Ait. Starry Campion.
Common everywhere.

162. Virginica, L. Fire Pink.
Butler, (Letterman), Iron, (Broadhead), St. Louis, (Riehl).

163. **Lychnis** *Githago*, Lam. Corn Cockle.
Common in wheat fields.

164. **Cerastium** arvense, L. Field Chickweed.
Miller, (Winick).

165. nutans, Raf.
Common everywhere.

166. oblongifolium, Torr.
Boone, (Tracy).

167. *viscosum*, L. Large Chickweed.
Boone, (Tracy), Jackson, (Bush), Pike, (Pech), St. Louis, (Murtfeldt).

168. *vulgatum*, L. Mouse-ear Chickweed.
Pike, (Pech).

169. **Stellaria** *media*, Smith. Common Chickweed.
Boone, (Tracy), St. Louis, (Murtfeldt).

170. longifolia, Muhl. Long-leaved Stitchwort.
St. Louis, (Riehl).

170½. borealis, Big. Northern Starwort.
Boone, (Galloway).

171. **Arenaria** lateriflora, L. Sandwort.
Jackson, (Mann).

172. Michauxii, Hook.
Livingston, (Broadhead).

173. patula, Michx.
Jackson, (Bush), Washington, (Riehl).

174. Pitcheri, Nutt.
Common everywhere.

175. squarrosa, Michx. Pine-barren Sandwort.
Jefferson, (Letterman).

176. stricta, Michx.
Greene, (Broadhead).

177. **Sagina** procumbens, L. Pearlwort.
St. Louis, (Riehl.)
178. **Spergula** *arvensis*, L. Corn Spurrey.
Boone, (Tracy.)

PARONYCHIEÆ.

179. **Paronychia** dichotoma, Nutt. Whitlow-wort.
Osage, (Broadhead.)
180. **Anychia** dichotoma, Michx. Forked Chickweed.
Common.
181. var, capillacea, Torr.
Jackson, (Bush & Mann.)

PORTULACACEÆ.

Purslane Family.

182. **Portulaca** *oleracea*, L. Purslane.
Common in gardens.
183. **Talinum** teretifolium, Pursh.
Common south of Mo. River.
184. **Claytonia** Caroliniana, Michx.
Boone, (Tracy,) Greene, (Shepard.)
185. Virginica, L. Spring Beauty.
Common everywhere.

ELANTINACEÆ.

Waterwort Family.

186. **Elatine** Americana, Arnott. Waterwort.
(Watson, in King's Fifth Report.)

HYPERICACEÆ.

St. John'swort Family.

187. **Ascyrum** Crux-Andreæ, L St. Andrew's Cross.
Greene, (Shepard).
188. **Hypericum** adpressum, Barton. St. John's-wort.
Jackson & Henry, (Bush). St. Louis, (Kellogg).

189. angulosum, Michx.
Mississippi, (Galloway).

190. aureum, Bartram.
Pike, (Pech).

191. Canadense, L.
Greene, (Shepard).

192. corymbosum, Muhl.
Boone, (Tracy), Jackson, (Bush), Miller, (Winich), Pettis, (McCluney), St. Louis, (Murtfeldt).

193. Drummondii, Torr & Gr.
Greene, (Bush), St. Louis, (Riehl), S. W. Mo., (Broadhead).

194. ellipticum, Hook.
Pike, (Pech).

195. graveolens, Buckl.
Pike, (Broadhead).

196. mutilum, L.
Greene, (Shepard), Jackson. (Bush), Pike, (Pech).

197. nudiflorum, Michx.
Greene, (Shepard).

198. prolificum, L. Shrubby St. John's-wort.
Common.

199. pyramidatum, Ait. Great St. John's-wort.
Jackson—*rare*, (Bush).

200. Sarothra, Michx. Pine-weed.
Greene, (Shepard), Iron & St. Louis, (Letterman).

201. sphærocarpon, Michx.
Barton, Cass & Pike, (Broadhead), Boone, (Galloway).

MALVACEÆ.

Mallow Family.

202. **Malva** *crispa*, Gray. Curled Mallow.
Jackson-*escaped*—(Bush).

203. *rotundifolia*, L. Common Mallow.
Common everywhere.

204. *sylvestris*, L. High Mallow.
Jackson, (Bush), Miller, (Winick), St. Louis, (Murtfeldt).

205. **Callirrhoe** digitata, Nutt.
Greene, (Letterman), Jasper & Lawrence, (Broadhead).

206. involucrata, Gray.
Jasper, (Letterman).

207. triangulata, Gray.
Mississippi, (Galloway).

208. **Malvastrum** angustum, Gray. False Mallow.
Cass, (Broadhead), Jackson, (Bush), Pike, (Pech), St. Louis, (Letterman).

209. **Sida** hispida.
Cass, (Broadhead).

210. *spinosa*, L.
Common everywhere.

211. **Abutilon** *Avicennæ*, Gærtn. Velvet Leaf,
Common everywhere.

212. **Hibiscus** grandiflorus, Michx. Rose Mallow.
St. Louis, (Letterman).

213. militaris, Cav. Halberd Leaved Mallow.
Cass, (Broadhead), Jackson, (Bush), Pettis, (McCluney), Pike; (Pech), Mississippi, (Galloway).

214. Moscheutos, L. Swamp Rose Mallow.
Barton, (Broadhead), Mississippi, (Galloway).

215. *Syriacus*, L. Shrubby Althea.
Cass, (Broadhead), Pettis, (McCluney).

216. *Trionum*, L. Bladder Ketmia.
Common everywhere.

TILIACEÆ.

Linden Family.

217. **Tilia** Americana, L. Basswood.
Common everywhere.

LINACEÆ.

Flax Family.

218. **Linum** Bootii. Englm.
Cass, (Broadhead).

219. perenne, L.
(Watson, in King's Fifth Report).

220, rigidum, Pursh.
"Missouri," (Mrs. Lincoln's Botany).

221. striatum, Walt.
Pike, (Broadhead).

222. sulcatum, Riddell.
Jackson, (Bush), Maries, (Broadhead).

223. *usitatissimum*, L. Common Flax.
Occasionally escaped.

224.	Virginianum, L.		Common.

GERANIACÆ.

Geranium Family.

225.	**Geranium** Carolinianum, L.	Carolina Cranesbill.	Common.
226.	*dissectum*, L.	Cut-leaved Cranesbill.	Pike (Pech).
227.	maculatum, L.	Wild Cranesbill.	Common.
228.	Robertianum, L.	Herb Robert.	Greene (Shepard).
229.	**Flœrkea** proserpinacoides, Willd.	False Mermaid.	St. Charles (Egeling).
230.	**Oxalis** *corniculata*, L.	Yellow Wood Sorrel.	Pike (Pech).
231.	var. stricta, L.		Common.
232.	violacea, L.	Violet Wood Sorrel.	Common.
233.	**Impatiens** fulva, Nutt.	Spotted Touch-me-not.	Common.
234.	pallida, Nutt.	Pale Touch-me-not.	Common.

RUTACEÆ.

Rue Family.

235.	**Zanthoxylum** Americanum, Mill.	Prickly Ash.	Common.
236.	**Ptelea** trifoliata, L.	Hop Tree.	Common, except in N. W., (Broadhead).

SIMARUBEÆ.

237.	**Ailanthus** *glandulosus*, Desf.	Tree of Heaven.	Boone and St. Louis, (Tracy), Jackson, (Bush).

AQUIFOLIACEÆ.

Holly Family.

238. **Ilex** decidua, Walt.
Common in Southern Mo.

239. lævigata, Gray. Smooth Winterberry.
(Swallow).

240. opaca, Ait. American Holly.
Butler, (Letterman), Mississippi, (Galloway).

241. verticillata, Gray. Black Alder.
Boone, (Swallow), Iron, (Letterman), Mississippi, (Galloway), Pike, (Pech).

CELASTRACEÆ.

Staff-Tree Family.

242. **Euonymus** Americanus, L. Strawberry Bush.
Boone, (Tracy), Eastern Missouri, (Broadhead), Mississippi and New Madrid, (Galloway).

343. atropurpureus, Jacq. Waahoo.
Common everywhere.

244. **Celastrus** scandens, L. Climbing Bitter-sweet.
Common everywhere.

RHAMNACEÆ.

Buckthorn Family.

245. **Berchemia** volubilis DC. Supple-jack.
Butler, (Letterman), Stone, (Broadhead).

246. **Rhamnus** Caroliniana, Walter. Buckthorn.
Iron & St. Louis, (Letterman), Common S. E., (Broadhead).

247. lanceolatus, Pursh.
Boone, (Galloway), Jackson, (Bush), St. Louis, (Letterman) Western Missouri, (Broadhead).

248. **Ceanothus** Americanus, L. New Jersey Tea.
Common everywhere.

249. ovalis, Bigel.
Northern and Western Missouri, (Broadhead).

VITACEÆ.

Grape Family.

250. **Vitis** æstivalis, Michx. Summer Grape.
Rare West, common elsewhere.
251. bipinnata, Torr. & Gray.
Common Southeast.
252. cinerea, Engelm. Ashy Grape.
Common on river bottoms.
253. cordifolia, Michx. Frost Grape.
Common.
254. ndivisa, Wild.
Common Southward.
255. palmata, Vahl.
Banks of Mississippi above St. Louis, (Eggert).
256. riparia, Michx. Frost Grape.
Common everywhere.
257. rupestris, Scheele. Sand Grape.
Banks of the Missouri river Southward.
258. vulpina, L. Muscadine.
Montgomery, Maries and Southward, (Broadhead).
259. **Ampelopsis** quinquefolia, Michx. Virginia Creeper.
Common everywhere.

SAPINDACEÆ.

Soapberry Family.

260. **Æsculus** flava, Ait. Sweet Buckeye.
Common.
261. glabra, Willd. Ohio Buckeye.
Common, excepting Westward.
262. Pavia, L, Red Buckeye.
S. E. Missouri, (Letterman).
263. **Acer** dasycarpum, Ehrh. Soft Maple.
Common in low grounds.
264. Pennsylvanicum, L. Striped Maple.
Iron, (Galloway).
265. rubrum, L. Red Maple.
Callaway to S. E. Missouri.

266. saccharinum, Wang. Sugar Maple.
Common elsewhere but not found west of Nodaway river.
267. var. nigrum, Gray. Black Maple.
Boone, (Tracy), Jackson, (Bush),
268. **Negundo** aceroides, Mœnch, Box Elder.
Common everywhere.
269. **Staphylea** trifolia, L. Bladder-Nut.
Common.

ANACARDIACEÆ.

Cashew Family.

270. **Rhus** aromatica, Ait. Fragrant Sumach.
Common everywhere except extreme Northwest.
271. copallina, L. Dwarf Sumach.
Common everywhere.
272. cotinoides, Nutt.
Mississippi, (Galloway), St. Louis, (Broadhead).
273. glabra, L. Smooth Sumach,
Common.
274. Toxicodendron, L. Poison Sumach.
Common.
275. var. radicans, Torr.
Jackson, (Bush), Miller, (Winick).
276. typhina, L. Staghorn Sumach.
Common.
277. venenata, DC. Poison Dogwood.
Greene, (Shepard.

LEGUMINOSÆ.

Pulse Family.

278. **Baptisia** alba, R. Br. False Indigo.
Miller, (Winick), Sullivan, (Broadhead).
279. australis, R. Br. Blue False Indigo.
Benton, (Swallow), Greene, (Bush).
280. leucantha, Torr. & Gray.
Common.
281. leucophæa, Nutt.
Common.
282. tinctoria, R. Br. Wild Indigo.
Lewis, (Egeling).

283. **Crotalaria** sagittalis, L. Rattlebox.
Franklin & St. Louis, (Letterman), Jackson, (Bush), Pike, (Pech), common in S. W. Mo. (Broadhead).

284. **Lupinus** perennis, L. Wild Lupine.
Mississippi, (Galloway), St. Louis, (Murtfeldt).

285. **Medicago** *sativa*, L. Lucerne.
Spontaneous about old gardens.

286. *lupulina*, L.
Pettis, (McCluney).

287. **Melilotus** *alba*, Lam. White Melilot.
Common about old gardens.

288. *officinalis*, Willd. Yellow Melilot.
Jackson, (Bush).

289. **Trifolinm** *arvense*, L. Rabbit-foot Clover.
Mississippi, (Galloway).

290. *pratense*, L. Red Clover.
Common everywhere.

291. *procumbens*, L. Hop Clover.
Boone, (Galloway).

292. reflexum, L. Buffalo Clover
Boone, (Tracy), Greene, (Shepard), Pike, (Pech), St. Louis, (Letterman).

293. repens, L. White Clover.
Common everywhere.

294. stoloniferum, Muhl. Running Buffalo Clover.
Common everywhere.

295. **Psoralea** canescens, Michx.
Pike, (Pech).

296. esculenta, Pursh.
Bates & Cass, *rare*—(Broadhead), Miller, (Winick), St. Louis, (Letterman).

297. melilotoides, Michx.
Bates, (Broadhead), Miller, (Winick), St. Louis, (Letman).

298. Onobrychis, Nutt.
Pike, (Pech), St. Louis, (Letterman).

299. tenuiflora, Pursh.
Common.

300. **Amorpha** canescens, Nutt. Lead Plant.
Common everywhere.

301. fruticosa, L. False Indigo.
Common everywhere.

302. **Dalea** alopecuroides, Willd.
Cass, (Broadhead), Jackson, (Bush), St. Louis, along R. R., (Letterman).
303. aurea, Nutt.
On White River, (Nuttall).
304. **Petalostemon** candidus, Michx. Prairie Clover.
Common everywhere.
305. villosus, Nutt.
Mississippi, (Broadhead).
306. violaceus, Michx.
Common everywhere.
307. **Tephrosia** Virginiana, Pers. Goat's Rue.
Common everywhere.
308. **Wistaria** frutescens, DC. Wistaria.
Mississippi, (Swallow), Ray, (Broadhead).
309. **Robinia** Pseudacacia, L. Black Locust.
Common everywhere.
310. **Astragalus** Canadensis, L. Vetch.
Common everywhere.
311. caryocarpus, Ker. Ground Plum.
Boone, (Tracy), common in Western Missouri, (Broadhead).
312 distortus, Torr. & Gray.
Franklin, (Letterman), Greene, (Shepard), Pettis, (McCluney), West. Mo., (Broadhead).
313. gracilis, Nutt.
(Watson, in King's Fifth Report).
314. Mexicanus, A. DC.
Common everywhere.
315. microlobus, Gray.
(Watson, in King's Fifth Report)
316. Plattensis, Nutt.
Greene, (Shepard).
317. racemosus, Pursh.
On White River, (Nuttall).
318. **Oxytropis** Lamberti, Pursh. Loco.
Atchison (Broadhead).
319. **Glycyrrhiza** lepidota, Nutt. Wild Licorice.
Platte & Vernon, (Bush), St. Louis, (Letterman).
320. **Stylosanthes** elatior, Swartz. Pencil Flower.
Common.

321. **Desmodium** acuminatum, DC. Tick-trefoil.
Common.
322. Canadense, DC.
Jackson, (Bush).
323. canescens, DC.
Boone, (Galloway), Jackson, (Bush), St. Louis, (Murtfeldt).
324. var villosissimum, T & G.
Cass, (Broadhead), Pike, (Pech), St. Louis, (Drummond).
325. ciliare, DC.
Greene, (Shepard).
326. cuspidatum, T. & Gray.
Jackson, (Bush), Pike, (Pech).
327. Dillenii, Darl.
Jackson, (Bush), Pike, (Pech).
328. Illinoense, DC.
Jackson, (Bush & Mann).
329. lævigatum.
Pettis, (McCluney).
330. Marilandicum, Boott.
Jackson, (Bush), Pike, (Pech).
331. nudiflorum, DC.
Greene, (Shepard), Jackson, (Bush), Pike, (Pech).
332. paniculatum, DC.
Cass, (Broadhead), Jackson, (Bush), Pike, (Pech).
333. pauciflorum, DC.
Greene, (Shepard), Jackson, (Bush), Pike, (Pech).
334. rigidum, DC.
Jackson, (Bush), Pettis, (McCluney), Pike, (Pech).
335. rotundifolium, DC.
Greene & Wright, (Bush).
336. sessilifolium, Torr. & Gr.
Cass, (Broadhead), Jackson, (Bush), Pike, (Pech).
337. tenuifolium, Torr. & Gr.
Greene, (Shepard).
338. viridiflorum, Beck.
Cass, (Broadhead), Pike, (Pech).
339. **Lespedeza** capitata, Michx. Bush Clover
Common.
340. hirta, Ell.
Wright, (Bush).

341. procumbens, Michx.
Mississippi, (Galloway).

342. repens, Torr. & Gray.
Common.

343. reticulata, Pers.
Jackson, (Bush).

344. var. angustifolia, Maxim.
Jackson, (Bush), St. Louis, (Murtfeldt).

345. Stuvei, Nutt.
Marion, (Broadhead).

346. violacea, Pers.
Common.

347. var. divergens, Gray.
Jackson, (Bush).

348. var. angustifolia, Gray.
Jackson & Wright, (Bush).

349. **Vicia** Americana, Muhl. Vetch.
Jackson, (Bush).

350. Caroliniana, Walt.
Boone, (Galloway), Greene, (Shepard), Iron, (Broadhead).

351. **Lathyrus** maritimus, Big. Beach Pea.
Pike, (Pech).

352. palustris, L. Marsh Vetchling.
Boone, (Tracy), Pike, (Pech), Ray, (Swallow).

353. **Clitoria** Mariana, L. Butterfly Pea.
Boone, (Galloway), Iron & Madison, (Broadhead).

354. **Amphicarpæa** monoica, Nutt. Hog Pea-nut.
Cass & Jackson, (Broadhead), Pike, (Pech), St. Louis, (Murtfeldt); also a white variety in Cass & Jackson, (Broadhead).

355. **Apios** tuberosa, Mœnch. Ground-nut.
Common

356. **Phaseolus** diversifolius, Pers. Wild Bean.
Cass, (Broadhead), Jackson, (Bush), Pike, (Pech).

357. helvolus, L.
Jackson, (Bush).

358. pauciflorus, Benth.
Jackson, (Bush), Pike, (Pech), St. Louis, (Murtfeldt).

359. **Gymnocladus** Canadensis, Lam. Kentucky Coffee-tree.
Common everywhere.

360. **Gleditschia** monosperma, Walt. Water-Locust.
Howell, (Tracy), Mississippi & New Madrid, (Galloway), Wright, (Bush); mouth of Missouri & Meramec Rivers, (Letterman).

361. triacanthos, L. Honey Locust.
Common everywhere.

362. **Cassia** Chamæcrista, L. Partridge Pea.
Common.

363. Marilandica, L. Wild Senna.
Common.

364. nictitans, L. Wild Sensitive Plant.
Greene, (Shepard), Pike, (Pech), St. Louis, (Murtfeldt), Wright, (Bush).

365. obtusifolia, L.
St. Louis, (Riehl).

366. **Cercis** Canadensis, L. Red-bud.
Common everywhere.

367. **Desmanthus** brachylobus, Benth.
Cass, (Broadhead), Jackson, (Bush), Pike, (Pech), St. Louis, (Letterman).

368. **Schrankia** uncinata, Willd. Sensitive Briar
Common everywhere.

ROSACEÆ.

Rose Family.

369. **Prunus** Americana, Marshall. Wild Plum.
Common.

370. Chicasa, Michx. Chickasaw Plum.
Eastern, Central and Southern, but not in Northwest.

371. Pennsylvanica, L. Wild Red Cherry.
Adair, (Broadhead), Pike, (Pech), St. Louis, (Murtfeldt).

372. pumila, L. Dwarf Cherry.
Missouri, (Torr. & Gray).

373. serotina, Ehrh. Wild Black Cherry.
Common Northwest.

374. Virginiana, L. Choke Cherry.
Common everywhere.

375. umbellata, Ell.
Miller, (Winick).

376. **Spiræa** Aruncus, L Goat's Beard.
Pike, (Pech), St. Louis, (Letterman), Wright, (Bush.)

377. betulifolia, Pallas.
Putnam, (Swallow).

378. salicifolia, L. Meadow Sweet.
Boone, (Tracy), Greene, (Shepard), Jackson, (Bush).

379. tomentosa, L. Steeple-Bush.
Boone, (Tracy), Clark and Cooper, (Swallow), Harrison, (Broadhead).

380. **Neillia** opulifolia, Benth & Hook. Nine-Bark.
Boone, (Tracy), Jackson, (Bush), Eastern and Southern Mo., (Broadhead).

381. **Gillenia** stipulacea, Nutt. American Ipecac.
Boone, (Tracy), Pike, (Pech), Common South of Missouri river.

382. trifoliata, Mœnch. Bowman's Root.
St. Louis and Iron, (Letterman).

383. **Rubus** Canadensis, L. Dewberry.
Common everywhere.

384. cuneifolius, Pursh. Sand Blackberry.
Pike, (Pech).

385. occidentalis, L. Black Raspberry.
Common.

386. strigosus, Michx. Red Raspberry.
Common.

387. trivialis, Michx. Low Bush Blackberry.
Common.

388. villosus, Ait. High Blackberry.
Common.

389. var. frondosus, Torr.
Jackson, (Bush).

390. **Geum** album, Gmelin. Avens.
Common in dry woods.

391. macrophyllum, Willd.
Nodaway, (Broadhead).

392. rivale, L. Purple Avens.
Pike, (Pech), St. Louis, (Riehl).

393. triflorum, Pursh. Three-Flowered Avens.
(Watson in King's 5th Report.

394. vernum, Torr. & Gray.
Common in Southeast.

395. Virginianum, L.
Jackson, (Bush), Pike (Pech), St. Louis, (Murtfeldt).

396. **Fragaria** vesca, L. Strawberry.
Greene, (Shepard).

397. Virginiana, Ehrh. Strawberry.
Common.

398. var. Illinoensis, Gray.
Jackson, (Bush), Miller, (Winick), St. Louis, (Murtfeldt), Pettis, (McCluney).

399. **Potentilla** argentea, L. Silvery Cinque-foil.
Greene, (Shepard).

400. arguta, Pursh.
(Torrey & Gray.)

401. millegrana, Engelm.
Jackson, (Bush).

402. Canadensis, L. Five-finger.
Common everywhere.

403. var. simplex, T. & Gray.
Boone, (Tracy), Greene, (Shepard).

404. Norvegica, L.
Common.

405. paradoxa, Nutt.
Jackson, (Bush), St. Louis, (Letterman).

406. rivalis, Nutt.
Jackson, (Bush).

407. var. pentandra, Watson.
Jackson, (Bush).

408. supina, L.
Jackson, (Bush), St. Louis, (Riehl).

409. **Agrimonia** Eupatoria, L. Agrimony.
Common everywhere.

410. parviflora, Ait. Small-flowered Agrimony.
Jackson, (Bush), St. Louis, (Murtfeldt.)

411. **Rosa** blanda, Ait. Early Wild Rose.
Common.

412. Carolina, L. Swamp Rose.
Boone, (Tracy), Common South of the Missouri river.

413. lucida, Ehrh. Dwarf Wild Rose.
Common everywhere.

414. nitida, Wild.
Jackson, (Bush).

415. *rubiginosa*, L. Sweet Brier.
Naturalized in Boone, (Tracy).

416. setigera, Michx. Climbing Rose.
Common. Occasionally found with very double flowers.

417. **Pirus** angustifolia, Ait. Narrow-leaved Crab Apple.
Jackson, (Bush), Mississippi, (Galloway), St. Louis, (Tracy).

418. arbutifolia, L. Choke-Berry.
Holt, (Broadhead).

419. coronaria, L. Crab-Apple.
Common everywhere.

420. **Cratægus** apiifolia, Michx. Hawthorn.
Butler, (Letterman).

421. arborescens, Ell.
Mouth of Meramec river, (Letterman), St. Louis. (Engelmann),

422. coccinea, L. Scarlet-Fruited Thorn.
Common.

423. var. viridis, T. & G.
Miller, (Winick).

424. cordata, Ait. Washington Thorn.
Boone. (Tracy), St. Charles, (Broadhead).

425. Crus-galli, L. Cockspur Thorn.
Common.

426. flava, Ait. Summer Haw.
Boone, (Tracy), Putnam, (Swallow).

427. *Oxyacantha*, L. English Hawthorn.
Boone, (Tracy), Montgomery, (Broadhead).

428. spathulata. Michx.
Boone, (Tracy), Miller, (Winick), St. Charles, (Broadhead).

429. subvillosa, Schrad.
Boone, (Tracy), Jackson, (Bush), St. Louis, (Letterman).

430. tomentosa, L. Black Thorn.
Common everywhere.

431. var. pyrifolia, Gray.
Boone, (Tracy), Jackson, (Bush).

432. var. punctata, Gray.
Boone, (Tracy), Jackson, (Bush), Pike, (Pech).

433. **Amelanchier** Canadensis, Torr & Gray.
Boone, (Tracy), Pike, (Pech).
Common South of Missouri river, but rare North.

434. var. alnifolia, Gray.
Jackson, (Bush).

435. var. oblongifolia, Gray.
Greene, (Shepard).

SAXIFRAGACEÆ.

Saxifrage Family.

436. **Saxifraga** Forbesii, Vasey.
St. Louis, (Letterman).

437. **Mitella** diphylla, L. Bishop's Cap.
Jefferson, (Letterman), St. Louis, (Kellogg).

438. **Heuchera** Americana, L. Alum Root.
Marion, (Broadhead).

439. hispida, Pursh.
Cass, (Broadhead), Greene, (Shepard), St. Charles, (Egeling).

440. villosa, Michx.
Pike, (Pech), St. Louis, (Murtfeldt).

441. **Hydrangea** aborescens, L. Wild Hydrangea.
Missouri River bluffs, (Broadhead), Pike, (Pech), St. Louis, (Tracy).

442. radiata, Walt.
Greene, (Shepard).

443. **Itea** Virginica, L.
Pike, (Swallow).

444. **Ribes** aureum. Pursh. Missouri Currant.
Common in rocky woodlands.

445. Cynosbati, L. Gooseberry.
Boone, (Tracy), Gasconade, (Broadhead).

446. gracile, Michx.
"Independence Co." (Nuttall).

447. rotundifolium, Michx. Gooseberry.
Common everywhere.

CRASSULACEÆ.

Orpine Family.

448. **Sedum** *acre*, L. Mossy Stone-crop.
Gentry, (Broadhead).

449. pulchellum, Michx.
Common.

450. stenopetalum, Pursh.
Greene, (Shepard).
451. Torreyi, Don.
Southwest, (Broadhead).
452. **Penthorum** sedoides, L. Ditch Stone-crop.
Common in wet places.

HAMAMELACEÆ.

Witch-Hazel Family.

453. **Hamamelis** Virginica. Witch-Hazel.
Iron, (Letterman), Only Southeast, (Broadhead).
454. **Liquidambar** Styraciflua, L. Sweet Gum.
Common Southeast.

HALORAGEÆ.

Water-Milfoil Family.

455. **Myriophyllum** scabratum, Michx.
Jackson, (Bush), Pike, (Pech).

MELASTOMACEÆ.

456. **Rhexia** Mariana, L. Deer Grass.
Mississippi, (Tracy).
457. Virginica, L.
St. Louis, (Geyer).

LYTHRACEÆ.

Loosestrife Family.

458. **Ammania** humilis, Michx.
Cass, (Broadhead), Jackson, (Bush), Pike, (Pech).
459. latifolia, L.
Cass, (Broadhead), Jackson, (Bush), Pike, (Pech), St. Louis, (Murtfeldt).
460. **Didiplis** linearis, Raf.
Greene, (Bush).
461. **Cuphea** viscosissima, Jacq. Clammy Cuphea.
Cass and Jackson, (Broadhead), Miller, (Winick), Mississippi, (Galloway), St. Louis, (Riehl).

462. **Lythrum** alatum, Pursh. Loosestrife.
Common.

463. **Nesæa** verticillata, H. B. K. Swamp Loosestirfe.

ONAGARACEÆ.

Evening Primrose Family.

464. **Epilobium** angustifolium, L. Great Willow Herb.
Pemiscot, (Swallow).

465. coloratum, Muhl.
Boone, (Tracy), Jackson, (Bush), Pike, (Pech).

466. **Jussiæa** pilosa, H. B. K.
St. Charles, (Egeling).

467. **Ludwigia** alata, Ell. False Loosestrife.
Jackson, (Bush).

468. alternifolia, L. Seed Box.
Pike, (Pech), Common South of Mo. River.

469. linearis, Walt.
Pike, (Pech).

470. palustris, Ell. Water Purslane.
Jackson, (Bush), St. Louis, (Riehl).

471. polycarpa, Short & Peter.
Jackson, (Bush).

472. **Œnothera** biennis, L. Evening Primrose.
Common everywhere.

473. var. grandiflora, Lindl.
(Watson, in King's 5th Report).

474. fruticosa, var. linearis, Watson. Sundrops.
Jefferson, (Tracy).

475. glauca, Michx.
Webster, (Swallow).

476. linifolia, Nutt.
Cass and Webster, (Broadhead), Franklin, (Letterman).

477. Missouriensis, Sims.
St. Louis and Ozark Mountain region.

478. riparia, Nutt.
Mississippi, (Galloway).

479. serrulata, Nutt.
Atchison & Vernon, (Broadhead).

480. sinuata, L.
Clay & Jackson, (Bush), Pettis, (McCluney), **Pike,** (Pech), Vernon, (Broadhead).
481. var. minima, Nutt.
Jackson, (Bush).
482. speciosa, Nutt.
Cass & Jackson, (Broadhead).
483. **Gaura** biennis, L.
Common.
484. filipes, Spach.
Pettis, (McCluney).
485 parviflora, Dougl.
Jackson, (Bush).
486. **Circaea** Lutetiana, L. Enchanter's Nightshade.
Common.

LOASACEÆ.

487. **Mentzelia** oligosperma, Nutt.
Not rare on dry plains.

PASSIFLORACEÆ.

Passion Flower Family.

488. **Passiflora** incarnata, L. Passion Flower.
Mississippi, (Tracy), Pemiscot, (Swallow).
489. lutea, L.
Common from St. Louis South and West.

CUCURBITACEÆ.

Gourd Family.

490. **Echinocystis** lobata, Torr. & Gray. Wild Balsam Apple.
Common.
491. **Sicyos** angulatus, L. Star Cucumber.
Common.

CACTACEÆ.

Cactus Family.

492. **Opuntia** Missouriensis, DC. Prickly-Pear.
Found occasionally, (Broadhead).

493. Rafinesquii, Engelm.
Greene, (Shepard), Jackson, (Bush).
494. vulgaris, Mill.
St. Louis, (Murtfeldt).

FICOIDEÆ.

495. **Mollugo** verticillata, L. Carpet Weed.
Boone, (Tracy), Jackson, (Bush), Pike, (Pech), St. Louis, (Riehl).

UMBELLIFERÆ.

Parsley Family.

496. **Eryngium** prostratum, Nutt.
Butler, (Letterman).
497. yuccæfolium, Michx. Rattlesnake Weed,
Common.
498. **Sanicula** Canadensis, L. Black Snakeroot.
Jackson, (Bush), Miller, (Winick), St. Louis, (Murtfeldt).
499. Marilandica, L.
Common.
500. **Erigenia** bulbosa, Nutt. Harbinger of Spring.
Common in woodlands.
501. **Bupleurum** *rotundifolium*, L. Through-wax.
Southwest, (Broadhead).
502. **Cicuta** maculata, L. Musquash Root.
Common.
503. **Sium** cicutæfolium, Gmel. Water Parsnip.
Cass, (Broadhead). Jackson, (Mann), Pike, (Pech).
504. **Pimpinella** integerrima, DC.
Common.
505. **Cryptotænia** Canadensis, DC. Honewort.
Cass, (Broadhead), Jackson, (Bush), Pike, (Pech).
506. **Osmorrhiza** brevistylis, D. C. Hairy Sweet Sicily.
Pike, (Pech), St. Louis, (Letterman).
507. longistylis, DC. Smooth Sweet Sicily.
Common in rich woods.
508. **Chærophyllum** procumbens, Lam. Chervil.
Common.
509. Teinturieri, Hook. & Arn.
Jackson, (Bush).

510. **Discopleura** Nuttallii, DC. Mock Bishop-weed.
Common everywhere.

511. **Ligusticum** actæifolium, Michx. Angelico.
St. Louis, (Letterman).

512. **Thaspium** aureum, Nutt. Meadow Parsnip.
Common.

513. barbinode, Nutt.
Boone, (Tracy), Cass, (Broadhead), Greene, (Shepard).

514. trifoliatum, Gray.
Johnson and Madison, (Broadhead).

515. var. atropurpúreum, T. & Gray.
Jackson, (Bush).

516. **Angelica** Curtisii, Buckl. Angelica.
Pike, (Pech).

517. **Archangelica** atropurpurea, Hoffm. Great Angelica.
Jackson, (Bush).

518, Gmelini, DC.
Pike, (Pech).

519. hirsuta, Torr & Gray.
Greene, (Shepard), Iron, (Letterman).

520. **Peucedanum** fœniculaceum, Nutt.
Cass, (Broadhead), Jackson, (Bush).

521. **Archemora** rigida, D. C. Cowbane.
Greene, (Shepard).

522. **Heracleum** lanatum, Michx. Cow-Parsnip.
Cass, Clinton and Linn, (Broadhead).

523. **Polytænia** Nuttallii, DC.
Jackson, (Bush).

524. **Conioselenium** Canadense, T. & G. Hemlock Parsley.
Boone, (Tracy), Sullivan, (Broadhead).

525. **Daucus** *Carota*, L. Carrot.
Occasionally persistent in old fields.

526. **Pastinaca** *sativa*, L. Parsnip.
Occasionally naturalized.

ARALIACEÆ.

Ginseng Family.

527. **Aralia** nudicaulis, L. Wild Sarsaparilla.
Boone, (Tracy), Pike, (Pech).

528. quinquefolia, Gray. Ginseng.
Common in rich woodlands.

529. racemosa, L. Spikenard.
Iron, (Broadhead), Pike, (Pech), St. Louis, (Letterman.)
530. spinosa, L. Hercules' Club.
Becoming common South.

CORNACEÆ.

Dogwood Family.

531. **Cornus** asperifolia, Michx. Rough-leaved Dogwood.
Common.
532. circinata, L'Her. Round-leaved Dogwood.
Bluffs of Miss. and Mo. Rivers in Eastern part of State.
533. florida, L. Flowering Dogwood.
Common, except Northwest.
534. paniculata, L'Her. Panicled Cornel.
Common.
535. sericea, L. Kinnikinnick.
Common.
536. stolonifera, Michx. Red-osier Dogwood.
Johnson, (Bush), Mississippi, (Galloway).
537. **Nyssa** multiflora, Wang. Sour Gum.
Common South.
538. uniflora, Walt. Large Tupelo.
Common Southeast.

CAPRIFOLIACEÆ.

Honeysuckle Family.

539. **Sambucus** Canadensis, L. Common Elder.
Common everywhere.
540. **Viburnum** dentatum, L. Arrow wood.
Common.
541. lantanoides, Michx. Hobble-bush.
Madison, (Broadhead), St. Louis, (Tracy).
542. Lentago, L. Sheep-berry.
Jackson, Greene, (Bush), Miller, (Winick), St. Louis, (Letterman).
543. Opulus, L. Cranberry-tree.
St. Louis, (Murtfeldt).

544. prunifolium, L. Black Haw.
Not found west of Gentry and Buchanan, (Broadhead), common Eastward.

545. **Triosteum** perfoliatum, L. Fever-wort.
Common.

546. angustifolium, L. Narrow-leaved Fever-wort.
Miller, (Winick).

547. **Smyphoricarpus** vulgaris, Michx. Buck-bush.
Common everywhere.

548. **Lonicera** flava, Sims. Yellow Honeysuckle.
Common.

549. glauca, Hill.
Buchanan, (Broadhead), Jackson, (Bush).

550. grata, Ait. American Woodbine.
Daviess, (Broadhead).

551. hirsuta, Eaton. Hairy Honeysuckle.
Ralls, (Broadhead).

552. parviflora, Lam. Small Honeysuckle.
Jackson, (Bush), Pike, Pech), Ralls, (Broadhead).

553. sempervirens, Ait. Trumpet Honeysuckle.
Jackson, (Bush).

RUBIACEÆ.

Madder Family.

554. **Houstonia** angustifolia, Michx.
Bates, Butler, (Broadhead), Wright, (Bush).

555. cærulea, L. Bluets.
Clay, (Broadhead).

556. minima, Beck. Small Bluets.
Pike, (Pech), St. Louis, (Geyer).

557. purpurea, L. Purple Bluets.
St. Louis, (Riehl), common Southwest, (Broadhead).

558. var. ciliolata, Gray.
Greene, (Shepard).

559. var. longifolia, Gray.
Laclede, (Broadhead), (Miller, (Winick), St. Louis, (Geyer).

560. var. tenuifolia, Gray.
St. Louis, (Murtfeldt).

561. **Oldenlandia** glomerata, Michx.

Greene, (Shepard), Pike, (Pech).

562. **Cephalanthus** occidentalis, L. Button Bush.

Common along streams.

563. **Diodia** Virginana, L. Button Weed.

Mississippi, (Galloway).

564. teres, Wait.

Common Southward.

565. **Galium** Aparine, L. Goose Grass.

Common everywhere.

566. asprellum, Michx. Rough Bedstraw.

Cass, (Broadhead), St. Louis, (Riehl).

567. Arkansanum, Gray.

(Engelmann).

568. circæzans, Michx. Wild Licorice.

Boone, (Tracy), Jackson, (Bush), St. Louis, (Riehl).

569. concinnum, T. & Gray.

Common.

570. latifolium, Michx.

Boone, (Tracy,) Greene, (Bush).

571. pilosum, Ait.

Pike, (Pech).

572. trifidum, L. Small Bedstraw.

Cass, (Broadhead), Jackson, (Bush), St. Louis, (Riehl).

573. triflorum, Michx. Sweet-scented Bedstraw.

Jackson, (Bush), Pike, (Pech), St. Louis, (Murtfeldt).

574. virgatum, Nutt.

Iron, Jefferson, St. Louis, Washington, (Letterman).

VALERIANACEÆ.

575. **Valeriana** pauciflora, Michx. Valerian.

(Gray in Flora of N. A.)

576. **Valerianella** radiata, Michx. Corn Salad.

Bates (Broadhead), Boone, (Tracy), Jackson, (Bush).

577. stenocarpa, Krok.

Jackson, (Bush).

578. chenopodifolia, DC.

Boone, (Galloway).

DIPSACEÆ.

Teasel Family.

579. **Dipsacus** *sylvestris*, Mill. Wild Teasel.
Franklin, St. Louis, (Letterman), Greene, (Shepard).

COMPOSITÆ.

Sunflower Family.

580. **Elephantopus** Carolinianus, Willd. Elephant's Foot.
Boone, (Tracy), Jackson, (Bush), Pike, (Pech), St. Louis, (Letterman).

581. **Vernonia** Arkansana, DC. Ironweed.
Common Southward.

582. altissima, Nutt.
Cass, Pettis, (Broadhead), Jackson, (Bush).

583. Baldwinii, Torr.
Eastern Mo., (Gray).

584. fasciculata, Michx.
Jackson, (Bush), Pike, (Pech), St. Louis, (Murtfeldt).

585. Noveboracensis, Willd.
Common.

586. var, latifolia, Gray,
Greene and Jackson, (Bush).

587. **Eupatorium** ageratoides, L. White Snake-root.
Common.

588. altissimum, L.
Common.

589. aromaticum L.
Jackson, rare, (Bush), Pettis, (McCluney).

590. cœlestinum, L.
Pike, (Pech), St. Louis, (Tracy), Southern Mo., (Broadhead).

591. perfoliatum, L. Thoroughwort.
Common everywhere.

592. var. cuneatum, Eng.
Eastern Mo., (Engelmann).

593. purpureum, L. Joe-Pye Weed.
Common.

594. serotinum, Michx.
Jackson, (Bush), Pettis, (McCluney), Pike, (Pech), St. Louis, (Murtfeldt).

595. sessilifolium, L. Upland Boneset.
Boone, (Galloway), Wright, (Bush).

596. **Kuhnia** eupatorioides, L.
Cass, (Broadhead), Jackson, (Bush), Pike, (Pech), St. Francois, (Galloway).

597. **Liatris** cylindracea, Michx. Blazing Star.
Common.

598. elegans, Willd.
Boone, (Galloway), Nodaway, Pike, Ralls, (Broadhead).

599. graminifolia, Pursh. var. dubia, Gray.
Pike, (Pech).

600. punctata, Hook.
Jackson, (Bush).

601. pycnostachya. Michx.
Audrain, (Tracy), Cass, (Broadhead), Jackson, (Bush). Pettis, (McCluney), St. Louis, (Murtfeldt).

602. scariosa, Willd.
Common everywhere.

603. spicata, Willd.
Jackson, (Mann).

604. squarrosa, Willd.
Common.

605. **Aphiachyris** dracunculoides, Nutt.
Common Westward, (Broadhead).

606. **Grindelia** lanceolata, Nutt.
Wright, (Bush).

607. squarrosa, Dunal.
In a few Southwestern counties.

608. var. nuda, Gray.
St. Louis, (Gray in Flora of N. A).

609. **Aplopappus** ciliatus, DC.
(Gray in Flora of N. A).

610. **Solidago** bicolor, L. Golden Rod.
Boone, (Galloway).

611. var. concolor, Torr. & Gray.
Wright, (Bush).

612. Canadensis, L.
Common.

613. var. scabra, Torr. & Gray.
Jackson, (Bush).
614. Drummondii, Torr. & Gray.
Boone, (Tracy) St. Louis, (Drummond).
615. Gattingeri, Chapm.
St. Louis, (Letterman), Wright, (Bush).
616. lanceolata, L.
Jackson, (Bush).
617. latifolia, L.
Pike, (Pech), St. Louis, (Letterman).
618. Missouriensis, Nutt.
Common on dry prairies.
619. nemoralis, Ait.
Boone, (Galloway), Jackson, (Bush), St. Louis, (Murtfeldt).
620. patula, Muhl.
(Gray in Flora N. A).
621. petiolaris, Ait.
Greene. (Shepard), Wright, (Bush).
622. puberula, Nutt.
Butler, (Letterman).
623. radula, Nutt.
Jackson, (Bush).
624. Riddellii, Frank.
St. Charles, (Egeling), St. Louis, (Engelmann).
625. rigida, L.
Common.
626. rupestris, Raf.
Jackson, (Bush).
627. serotina, Ait.
Jackson, (Bush), St. Louis, (Murtfeldt).
628. var. gigantea, Gray.
Cass, (Broadhead), Jackson, (Bush), Pike, (Pech).
629. Shortii, Torr. & Gray.
Wright, (Bush).
630. speciosa, Nutt.
Common Westward.
631. var. rigidiuscula, Torr. & Gray.
Jackson, (Bush). St. Louis, (Engelmann).
632. tenuifolia, Pursh.
Common Westward.

633. ulmifolia, Muhl.
Boone, (Tracy), Jackson, (Bush), Pike, (Pech).

634. **Chaetopappa** asteroides, DC.
(Gray in Flora N. A.)

635. **Boltonia** asteroides, L'Her.
Jackson, (Bush), Pike, (Pech).

636. var. decurrens, Engelm.
St. Louis, (Eggert).

637. latisquama, Gray.
Cass, (Broadhead), Jackson, (Parry), Pettis, (McCluney.

638. **Aster** anomalus, Engelm.
St. Louis, (Engelmann), Wright, (Bush).

639. azureus, Lindl.
Common.

640. cordifolius, L.
Boone, (Tracy), Cass, (Broadhead), Pike, (Pech).

641. diffusus, Ait.
Cass, (Broadhead), Pike, (Pech).

642. Drummondii, Lindl.
Jackson, (Bush), St. Louis, (Torr. & Gray.)

643. ericoides, L.
Jackson and Wright, (Bush), St. Louis, (Tracy).

644. var. villosus, T. &. G.
(Gray in Flora, N. A.)

645. grandiflorus, L.
Pike, (Pech).

646. junceus, Ait.
Greene, (Shepard).

647. lævis, L.
Common.

648. linariifolius, L.
Wright, (Bush).

649. longifolius, Lam.
St. Louis, (Murtfeldt).

650. multiflorus, Ait.
Common.

651. Novæ-Angliæ, L.
Common.

652. oblongifolius, Nutt.
Cass, (Broadhead), Jackson, (Bush),

653. paludosus, Ait.
(Gray in Flora, N. A.)
654. patens, Ait.
Greene, (Shepard), Wright, (Bush).
655. paniculatus, Lam.
Cass, (Broadhead), Jackson, (Bush).
656. ptarmicoides, T. & Gray.
Common Southward.
657. recticulatus, Pursh.
Cass and Jackson, (Broadhead.)
658. sagittifolius, Willd.
Greene, (Shepard), St. Louis, (Drummond).
659. salicifolius, Ait.
Cass, (Broadhead), Jackson, (Bush).
660. var. subasper.
St. Louis, (Drummond).
661. sericeus, Vent.
Common.
662. Shortii, Boot.
Pike, (Pech.)
663. tenuifolius, L.
Jackson, (Bush), St. Louis, (Murtfeldt).
664. Tradescanti, L.
Boone, (Galloway), Jackson, (Bush).
665. turbinellus, Lindl.
Common everywhere.
666. undulatus, L.
Boone, (Galloway).
667. **Erigeron** annuus, Pers. Fleabane.
Common everywhere.
668. bellidifolius, Muhl.
Common.
669. Canadensis, L.
Common.
670. divaricatus, Michx.
Common.
671. glabellus, Nutt.
"Missouri," (Nuttall).
672. Philadelphicus, L.
Common everywhere.
673. strigosus, Muhl.
Common.

674. **Pluchea** camphorata, DC. Salt-marsh Fleabane.
St. Louis, (Murtfeldt).

675. **Antennaria** plantaginifolia, Hook. Everlasting.
Common.

676. **Gnaphalium** decurrens, Ives. Everlasting.
Boone, (Galloway).

677. polycephalum, Michx.
Boone, (Tracy), Green and Jackson, (Bush), Pettis, (McCluney), St. Louis, (Riehl).

678. purpureum, L. Purple Cudweed.
St. Louis, (Riehl).

679. **Inula** *Helenium*, L.
Boone, (Tracy), Jackson, (Bush).

680. **Polymnia** Canadensis, L. Leaf Cup.
Pike, (Pech), St. Louis, (Letterman).

681. var. radiata, Gray.
Jackson, (Mann).

682. Uvedalia, L.
Butler and St. Louis, (Letterman.)

683. **Silphium** integrifolium, Michx.
Common.

684. laciniatum, L. Rosin Weed.
Common on dry prairies.

685. perfoliatum, L. Cup-Plant.
Common.

686. terebinthinaceum, L. Compass Plant.
Common on wet prairies.

687. **Berlandiera** Texana, DC.
Southwest Missouri, (Gray).

688. tomentosa, T. & Gray.
(Gray in Flora, N. A.)

689. **Parthenium** integrifolium, L.
Common.

690. ciliata, Willd. Hairy Marsh Elder.
Greene, Jackson, (Bush), Pike, (Pech).

691. frutescens, L.
Boone, (Galloway).

692. xanthiifolia, Nutt. Marsh Elder.
Common.

693. **Ambrosia** bidentata, Michx. Ragweed.
Cass, (Broadhead), Greene, (Shepard), Iron, (Letterman).

694. trifida, L. Great Ragweed.
Common everywhere.

695. var. integrifolia, T. & G.
Jackson, (Bush).

696. artemisiæfolia, L. Bitterweed.
Common.

697. psilostachya, DC.
Common Southward.

698. **Xanthium** Canadense, Mill. Cocklebur.
Common everywhere.

699. var. echinatum, Gray.
Boone, (Tracy), Cass, (Broadhead), Jackson, (Bush).

700. *spinosum*, L.
Perry, (Demetrio).

701. **Heliopsis** lævis, Pers. Ox-eye.
Miller, (Winick), St. Louis, (Tracy).

702. gracilis, Nutt.
Wright, (Bush).

703. scabra, Dunal.
Jackson, (Bush).

704. **Eclipta** alba, Hasskarl.
Jackson, (Bush), Pettis, (McCluney), Pike, (Pech), St. Louis, (Riehl).

705. **Echinacea** angustifolia, DC. Purple Cone-Flower.
Common everywhere.

706. purpurea, Mœnch.
Common.

707. **Rudbeckia** bicolor, Nutt. Cone-Flower.
Wright, (Bush).

708. fulgida, Ait.
Common.

709. hirta, L.
Common.

710. laciniata, L.
Common everywhere.

711. speciosa, Wend.
Jackson, (Bush), Pettis, (McCluney), St. Louis, (Riehl).

712. subtomentosa, Pursh.
Jackson, (Bush), Pike, (Pech).

713. triloba, L.
Common.

714. **Lepachys** pinnata, Torr. & Gray.
Cass, (Broadhead), Jackson, (Bush), Pike, (Pech).

715. **Helianthus** angustifolius, L. Sunflower.
Ralls, Vernon, (Broadhead.)

716. *annuus*, L. Common Sunflower.
Very common West, and becoming so East.

717. decapetalus, L.
Pike, (Pech).

718. divaricatus, L.
St. Louis, (Riehl).

719. doronicoides, Lam.
Common westward.

720. giganteus, L.
Pettis, (McCluney), Pike, (Pech), St. Louis, (Engelmann).

721. grosse-serratus, Martins.
Common.

722. hirsutus, Raf.
Cass, (Broadhead), Jackson, (Mann).

723. lætiflorus, Pers.
Cass, (Broadhead), Pettis, (McCluney), St. Louis, (Murtfeldt).

724. Maximiliani, Schrad.
Wright, (Bush).

725. mollis, Lam.
Common.

776. occidentalis, Riddell..
(Gray in Flora of N. A.)

777. orgyalis, D. C.
Vernon, (Broadhead).

778. petiolaris, Nutt.
Jackson, (Bush).

779. rigidus, Desf.
Common.

780. strumosus, L.
Jackson, (Bush).

781. tracheliifolius, Willd.
(Jackson, (Bush).

782. *tuberosus*, L. Artichoke.
Occasionally escaped.

783. var. subcanescens, Gray.
St. Louis, (Engelmann).

784. **Verbesina** helianthoides, Mx. Crownbeard.
Common everywhere.

785. Virginica, L.
Iron, (Letterman).

786. **Actinomeris** squarrosa, Nutt.
Jackson, (Bush), Pettis, (McCluney), Pike, (Pech), St. Louis, (Murtfeldt).

787. alba, T. & G.
Perry. (Demetrio).

788. **Coreopsis** aristosa, Michx. Tick-seed
Common.

789. var. mutica, Gray.
Jackson, (Bush).

790. auriculata, L.
Greene, (Shepard), Pettis, (McCluney), St. Louis, (Riehl).

791. discoida, Torr & Gray.
Pike, (Pech).

792. gladiata, Walt.
Newton, (Broadhead).

793. grandiflora, Nutt.
Common Southwest.

794. involucrata, Nutt.
Greene, Jackson, (Bush).

795. lanceolata, L.
Greene, Wright, (Bush), St. Louis, (Letterman).

796. palmata, Nutt.
Common.

797. pubescens, Ell.
(Gray in Flora of N. A.)

798. senifolia, Michx.
St. Louis, (Drummond).

799. tinctoria, Nutt.
Common about old gardens.

800. trichosperma, Michx. Tick-seed Sunflower.
Boone, (Tracy), Pike, (Pech).

801. tripteris, L. Tall Coreopsis.
Cass, (Broadhead), Jackson, (Bush), Lewis, (Egeling).

802. verticillata, L.
Lewis, (Egeling), Pettis, (McCluney).

803. **Bidens** Beckii, Torr. Water Marigold.
St. Louis, (Beck).

804. bipinnata, L. Spanish Needles.
Common everywhere.

805. cernua, L. Small Bur-Marigold.
Common.

806. chrysanthemoides, Mx Large Bur-Marigold.
Jackson, (Bush), Pike, (Pech).

807. connata, Muhl. Swamp Beggar-ticks.
Common everywhere.

808. frondosa, L. Common Beggar-ticks.
Common everywhere.

809. **Hymenopappus** tenuifolius, Pursh.
(Watson in King's 5th Report).

810. **Helenium** autumnale, L. Sneeze-weed.
Common.

811. nudiflorum, Nutt.
Pike, (Pech), St. Louis, (Letterman).

812. tenuifolium, Nutt.
Jackson, (Bush). Migrating toward St. Louis along I. M. R. R., (Letterman).

813. **Gaillardia** aristata, Pursh.
(Gray in Flora of N. A).

814. pinnatifida, Torr.
(Gray in Flora of N. A.).

815. **Dysodia** chrysanthemoides, Lag. Fetid Marigold.
Common.

816. **Anthemis** *arvensis*, L. Chamomile.
Waste places, St. Louis, (Murtfeldt).

817. *Cotula*, L. May-weed.
Along roadsides everywhere.

818. **Achillea** Millefolium, L. Milfoil.
Common everywhere, and becoming a troublesome weed Westward.

819. **Matricaria** discoidea, DC. Wild Chamomile.
St. Louis, (Engelmann).

820. **Chrysanthemum** *Leucanthemum*, L. Ox-eye Daisy.
Boone, (Galloway), Jackson and Randolph, (Bush), Pettis, (McCluney), St. Louis, (Murtfeldt).

821. **Tanacetum** *vulgare*, L. Tansy.
Common in old gardens.

822. **Artemisia** *annua*, L. Wormwood.
Jackson, (Bush).

823. biennis, Wild. Biennial Wormwood.
Jackson, (Bush), St. Louis, (Riehl).

824. Canadensis, Michx.
Pike, (Pech).

825. caudata, Michx.
(Torrey & Gray).

826. dracunculoides, Pursh.
Jackson, (Bush), St. Louis, (Engelmann).

827. frigida, Wild.
(Torrey & Gray).

828. Ludoviciana, Nutt. — Western Mugwort.
Common.

829. *vulgaris*, L. — Common Mugwort.
Common westward.

830. **Senecio** aureus, L. — Squaw-weed.
Common everywhere.

831. var. Balsamita, T. & G.
Jackson, (Bush).

832. lobatus, Pers. — Butter-weed.
Common.

833. tomentosus, Mx. — Wooly Ragwort.
Pike, (Pech).

834. *vulgaris*, L. — Common Groundsel
Boone. (Tracy).

835. **Cacalia** atriplicifolia, L — Pale Indian Plantain.
Common in damp woods.

836. reniformis, Muhl. — Great Indian Plantain.
Boone, (Tracy).

837. suaveolens, L. — Indian Plantain.
Pike, (Pech).

838. tubrosa, Nutt. — Tuberous Indian Plantain.
Common.

839. **Erechthites** hieracifolia, Raf. — Fireweed.
Common.

840. **Artium** *Lappa*, L. — Burdock.
Common in rich ground.

841. **Cnicus** altissimus, Willd. — Tall Thistle.
Common.

842. var. discolor, Gray.
Jackson (Bush).

843. *arvensis*, Hoff. — Canada Thistle.
Very rare, but has been found in Cass, Jackson and one or two other counties.

844. *lanceolatus*, Hoff. Common Thistle.
Common.

845. Virginianus, Pursh.
Greene, (Shepard).

846. **Apogon** humilis, Ell.
Bates, Cass, (Broadhead).

847. **Krigia** Virginica, Willd. Dwarf Dandelion.
Common Eastward.

848. Dandelion, Nutt.
St. Louis, (Engelmann).

849. **Cichorium** *Intybus*, Cichory.
Greene, (Shepard).

850. **Hieracium** Canadense, Michx. Canada Hawkweed.
Cass, (Broadhead).

851. Gronovii, L. Hairy Hawkweed.
Pike, (Pech), Wright, (Bush).

852. longipilum, Torr. Long-bearded Hawkweed.
Greene and Jackson, (Bush).

853. scabrum, Michx. Rough Hawkweed.
Wright, (Bush).

854. **Prenanthes** aspera, Mx. Rattlesnake Root.
Common.

355. altissima, L, Tall White Lettuce.
Wright, (Bush).

856. racemosa, Mx.
Greene, (Shepard).

857. crepidinea, Mx.
Pike, (Pech), St. Louis, (Riehl).

858. **Troximon** cuspidatum, Pursh.
Common.

859. **Taraxacum** officinale, Weber. Dandelion.
Common everywhere.

860. **Pyrrhopappus** Carolinianus, DC. False Dandelion.
Greene, (Shepard), Madison, (Broadhead), Mississippi, (Galloway).

861. scaposus, DC.
Bates and Vernon, (Broadhead).

862. **Lactuca** *scariola*, L. Prickly Lettuce.
Jackson, (Bush) "Thoroughly naturalized in St. Louis during the last eight years, and has now taken to the woods."—(Letterman.)

863. Canadensis, L.
Common.

864. integrifolia, T. & G.
Boone, (Tracy), Jackson, (Bush), St. Louis, (Murtfeldt).

865. hirsuta, Muhl.
Jackson, (Bush).

866. Ludoviciana, DC.
Jackson, (Bush).

867. Floridana, Gærtn.
Common along old fences.

868. acuminata, Gray.
Jackson, (Bush), St. Louis, Murtfeldt.

869. **Sonchus** *oleraceus*, L. Sow thistle.
Common.

870. *asper*, Vill. Spiny-leaved Sow-thistle.
Common everywhere.

871. *arvensis*, L. Field Sow-thistle.
Boone, (Galloway).

LOBELIACEÆ.

Lobelia Family.

872. **Lobelia** cardinalis, L. Cardinal Flower.
All parts, but becoming rare.

873. inflata, L Indian Tobacco.
Boone, (Tracy), Jackson, (Bush), Pettis, (McCluney), Pike (Pech), St. Louis, (Murtfeldt).

874. Kalmii, L.
Knox, (Broadhead).

875. leptostachys, A. DC.
Common.

876. puberula, Michx.
St. Louis, (Tracy).

877. spicata, Lam.
Common.

878. syphilitica, L Blue Lobelia.
Common everywhere.

CAMPANULACEÆ.

Campanula Family.

879. **Specularia** leptocarpa, Gray.
Common Westward.
880. perfoliata, A. DC. Venus' Looking-glass.
Common everywhere.
881. **Campanula** Americana, L. Tall Bell-flower.
Common.

ERICACEÆ.

Heath Family.

882. **Gaylussacia** resinosa, T. & G. Black Huckleberry.
Miller, (Winick).
883. dumosa, T. & G. Dwarf Huckleberry.
Newton, (Broadhead).
884. **Vaccinium** arboreum, Marshall. Farkleberry.
Common South and Southeast.
885. corymbosum, L. Swamp Blueberry.
Greene, (Shepard), Iron, (Broadhead).
886. Pennsylvanicum, Lam. Dwarf Blueberry.
Common Southeast.
887. stamineum, L. Deerberry.
Iron, (Letterman).
888. vacillans, Solander. Low Blueberry.
Boone, Howard. Greene and Southeast.
889. **Arctostaphylos** Uva-ursi, Spreng. Bearberry.
Southeast, (Broadhead).
890. **Leucothoe** racemosa, Gray.
Madison, (Broadhead).
891. **Rhododendron** nudiflorum, Torr. Purple Azalea.
Madison, (Broadhead).
892. **Schweinitzia** odorata, Ell. Sweet Pinesap.
St. Louis, (Murtfeldt).
893. **Monotropa** uniflora, L. Indian Pipe.
Common from Pike, Boone and Jackson Southward.

PRIMULACEÆ.

Primrose Family.

894. **Dodecatheon** Meadia, L. Shooting Star.
Common.

895. **Androsace** occidentalis, Pursh.
Franklin, St. Louis, (Letterman), Jackson, (Bush), Pike, (Pech).

896. **Steironema** ciliatum, Raf. Loosestrife.
Common

897. lanceolatum, Gray.
Cass, (Broadhead), St. Louis. (Riehl).

898. var. hybridum. Gray.
Jackson, Randolph, (Bush), Miller, (Winick).

/ 899. longifolium, Gray.
Boone, (Tracy), Greene, (Shepard), Madison, (Broadhead).

900. **Lysimachia** stricta, Ait.
St. Louis, (Murtfeldt).

901. *nummularia*, L. Moneywort.
Escaped from gardens in damp ground.

902. **Anagallis** *arvensis*, L. Pimpernel.
Jackson, (Bush), St. Louis, (Murtfeldt).

903. **Samolus** Valerandi, L. Water Pimpernel.
Pike, (Pech).

904. var. Americanus, Gray.
Greene, (Bush), St. Louis and Southeast, (Letterman).

SAPOTACEÆ.

Sapodilla Family.

905. **Bumelia** lanuginosa, Pers. Bumelia.
Occasionally from Missouri River bluffs Southward.

906. lycioides, Gærtn. Southern Buckthorn.
St. Louis and Southward, (Letterman).

907. tenax, Willd.
Miller, (Winick).

EBENACEÆ.

Ebony Family.

908. **Diospyros** Virginiana, L. — Persimmon.
Common except Northwest.

OLEACEÆ.

Ash Family.

909. **Fraxinus** Americana, L. — White Ash.
The most common species.

910. pubescens, Lam. — Red Ash.
Jackson, (Bush), Saline, (Galloway).

911. quadrangulata, Michx. — Blue Ash.
Common Eastward from Chariton, Howard and Greene.

912. sambucifolia, Lam. — Black Ash.
Boone, (Galloway), Callaway and Cedar, (Broadhead).

913. viridis, Michx. f. — Green Ash.
Boone, (Galloway), Jackson, (Bush), Ralls, (Broadhead).

914. **Forestiera** acuminata, Poir.
Pike, (Pech), Bank of Mississippi at mouth of Meramec River, (Letterman).

915. **Chionanthus** Virginica, L. — White Fringe.
Mississippi, (Galloway).

APOCYNACEÆ.

Dogbane Family.

916. **Amsonia** Tabernæmontana, Walt.
Common.

917. **Apocynum** androsæmifolium, L.
Boone, (Galloway), Greene, (Shepard), Jackson, (Bush), St. Louis, (Murtfeldt).

918. cannabinum, L. — Indian Hemp.
Common everywhere.

919. var. hypericifolium, Gray.
Pike, (Pech), Putnam, (Swallow).

ASCLEPIADACEÆ.

Milkweed Family.

920. **Anantherix** connivens, Gray.
Franklin & St. Louis, (Letterman), Miller, (Winick).

921. **Asclepiodora** viridis, Gray.
Jackson, (Bush).

922. **Asclepias** Cornuti, Decaisne. Silkweed.
Common everywhere.

923. incarnata, L. Swamp Milkweed.
Common.

924. Meadii, Torr.
Cass, (Broadhead), Jackson, (Bush), Putnam, (Swallow).

925. obtusifolia, Michx.
Cass, (Broadhead), Jackson, (Bush).

926. paupercula, Michx.
Gentry, (Swallow).

927. perennis, Walt.
Mississippi, (Galloway).

928. phytolaccoides, Pursh. Poke Milkweed.
Iron, (Broadhead).

929. purpurascens, L. Purple Milkweed.
Common.

930. quadrifolia, Jacq. Four-leaved Milkweed.
Common.

931. rubra, L. Red Milkweed.
Boone, (Galloway), St. Louis, (Murtfeldt).

932. Sullivantii, Engelm.
Cass & Daviess, (Broadhead), Jackson, (Bush).

933. tuberosa, L. Pleurisy Root.
Common everywhere.

934. variegata, L.
Boone, (Galloway).

935. verticillata, L. Whorled Milkweed.
Common.

936. viridula, Chapm.
Miller, (Winick).

937. **Acerates** lanuginosa. Decaisne. Green Milkweed.
White River, (Nuttall).

938. longifolia, Ell.
Common.

939. viridiflora, Ell.
Cass, (Broadhead), Jackson, (Bush), Pike, (Pech).

940. var. lanceolata, Gray.
Jackson, (Bush).

941. var. linearis, Gray.
Jackson, (Bush).

942. **Enslenia** albida, Nutt.
Jackson, (Bush), Lawrence, (Swallow), St. Louis, (Murtfeldt).

943. **Vincetoxicum** *nigrum*, Mœnch.
Jackson, (Tracy).

944. **Gonolobus** Carolinensis, R. Br.
Franklin, Iron and St. Louis, (Letterman).

945. lævis, Michx. var. macrophyllus, Gray.
Greene, (Shepard).

946. obliquus, R. Br.
Madison, (Broadhead).

LOGANIACEÆ.

Logania Family.

947. **Spigelia** Marilandica, L. Pink Root.
Madison, (Broadhead), St. Francois, (Tracy).

GENTIANACEÆ.

Gentian Family.

948. **Sabbatia** angularis, Pursh. American Centaury.
Common.

949. stellaris, Pursh.
Clay, (Mann).

950. **Gentiana** alba. Muhl. White Gentian.
Common Westward.

951. Andrewsii, Griseb. Closed Gentian.
Jackson, (Bush), St. Louis, (Letterman).

952. angustifolia, Michx. Narrow-leaved Gentian.
Pettis, (McCluney), Ripley, (Broadhead).

953. puberula, Michx.
Common.

954. quinqueflora, Lam. Five-flowered Gentian.
Adair, (Broadhead).

955. **Bartonia** tenella, Muhl.
Collected in Missouri by Swallow. No locality given.

956. **Limnanthemum** lacunosum, Griseb. Floating Heart.
"Missouri," (Meehan).

POLEMONIACEÆ.

Polemonium Family.

957. **Phlox** amœna, Sims. Sweet William.
Greene, (Shepard), Livingston, (Broadhead), Miller, (Winick).

958. bifida, Beck.
(Gray's Manual, 5th Ed).

959. divaricata, L.
Common everywhere.

960. glaberrima, L.
Clay and Saline, (Broadhead), Jackson, (Bush), St. Louis, (Letterman).

961. maculata, L. Common Wild Sweet William.
Common everywhere.

962. paniculata, L.
Common.

963. pilosa, L.
Common.

964. procumbens, Lehm.
Boone, (Galloway).

965. reptans, Michx.
Boone, (Tracy), Clay, (Broadhead), Knox, (Linn), Pike, (Pech).

966. **Polemonium** reptans, L. Greek Valerian.
Common in damp places.

HYDROPHYLLACEÆ.

Waterleaf Family.

967. **Hydrophyllum** appendiculatum, Michx. Waterleaf.
Common.

968. macrophyllum, Nutt.
Jackson, (Bush).

969. Virginicum, L.
Common.

970. **Ellisia** Nyctelea, L.
Common in damp soils.

971. **Phacelia** bipinnatifida, Michx..
"Missouri," (Meehan).

972. fimbriata. Michx.
Pike, (Pech), St. Louis, (Riehl).

973. parviflora, Pursh.
Greene, (Shepard).

974. var. hirsuta, Gray.
Greene, (Shepard), Jasper, (Broadhead).

975. Purshii, Buckl.
Clay, (Broadhead).

976. **Hydrolea** affinis, Gray.
Butler, (Lettermann).

977. quadrivalvis, Walt.
Mississippi, (Galloway).

BORRAGINACEÆ.

Borrage Family.

978. **Heliotropium** tenellum, Torr. Wild Heliotrope.
Franklin, Greene, Iron and St. Louis, (Letterman), Wright, (Bush).

979. *Indicum*, L. Indian Heliotrope.
Butler and St. Louis, (Letterman), Mississippi, (Galloway).

980. **Cynoglossum** *officinale*, L. Hound's Tongue.
Common about old gardens.

981. Virginicum, L. Wild Comfrey.
Boone, (Tracy), Jackson, (Bush).

982. **Echinospermum** Virginicum, Lehm. Stickseed.
Common.

983. **Mertensia** Virginica, DC. Virginian Cowslip.
Common in damp woods.

984. **Myosotis** arvensis, Hoffm. Forget-me-not.
Pike, (Pech).

985. verna, Nutt.
St. Louis, (Geyer).

986. **Lithospermum** *arvense*, L. Corn Gromwell.
Jackson, (Bush), St. Louis, (Murtfeldt).

987. angustifolium, Michx. Narrow-leaved Puccoon.
Common.

988. canescens, Lehm. Alkanet.
Common on dry hills.

989. hirtum, Lehm. Hairy Puccoon.
Common.

990. latifolium, Michx. Wide-leaved Puccoon.
Jackson, (Bush), Miller, (Winick).

991. **Onosmodium** Carolinianum, DC. False Gromwell.
Jackson, (Bush), St. Louis, (Murtfeldt).

992. var. molle, Michx.
Cass, (Broadhead), Jackson, (Bush).

993. Virginianum, DC.
Jackson, (Bush), Pike, (Pech).

994. **Echium** *vulgare*, L. Blue-weed.
Jackson, (Bush).

995. **Symphytum** *officinale*, L. Comfrey.
Boone, (Galloway).

CONVOLVULACEÆ.

Morning Glory Family.

996. **Ipomœa** coccinea, L. Cypress-vine.
Jackson, (Bush).

997. hederacea, Jacq.
Jackson, (Bush), Miller, (Winick), St. Louis, (Murtfeldt).

998. lacunosa, L.
Common.

999. pandurata, Meyer. Man-of-the-Earth.
Common.

1000. purpurea, Lam. Morning Glory.
A troublesome weed.

1001. Quamoclit, L.
Greene, (Shepard).

1002. **Convolvulus** sepium, L. Bindweed.
Common.

1003. spithamæus, L.
Greene, (Shepard).

1004. **Breweria** aquatica, Gray.
Scotland, (Swallow).

1005. **Evolvulus** argenteus, Pursh.
Franklin and St. Louis, (Letterman), Potosi in Washington (Gray's Manual, 5th Ed.)

1006. **Cuscuta** arvensis, Beyrich. Dodder.
Greene, (Shepard).

1007. chlorocarpa, Engelm.
Jackson, (Bush).

1008. compacta, Juss.
Boone, (Tracy).

1009. cuspidata, Engelm.
St. Louis, (Eggert).

1010. glomerata, Chois.
Common.

1011. Gronovii, Willd.
Pike, (Pech).

1012. tenuiflora, Engelm.
(Watson in King's 5th Report).

SOLANACEÆ.

Nightshade Family.

1013. **Solanum** Carolinense, L. Horse-Nettle.
Common everywhere.

1014. *Dulcamara*, L.
Boone, (Tracy), Jackson, (Bush), Pettis (McCluney), St. Louis, (Murtfeldt).

1015. *nigrum*, L. Nightshade.
Common.

1016. rostratum, Dunal.
Very common in Western Missouri, and spreading Eastward along railroads. Sometimes erroneously called "Canada Thistle."

1017. **Physalis** angulata, L. Ground Cherry.
St. Louis, (Riehl).

1018. Philadelphica, Lam.
Jackson, (Bush).

1019. pubescens, L.
Boone, (Tracy), Jackson, (Bush).

1020. lanceolata, Gray.
Cass and Jackson, (Broadhead), St. Louis, (Geyer).

1021. var. hirta, Gray.
Jackson, (Bush).

1022. var. lævigata, Gray.
Jackson, (Bush).

1023. Virginiana, Mill.
Jackson, (Bush).

1024. viscosa, L.
Common everywhere.

1025. **Nicandra** *physaloides*, Gærtn. Apple of Peru.
Boone, (Galloway), Jackson, (Bush), Pike, (Pech), St. Louis, (Murtfeldt).

1026. **Lycium** *vulgare*, Dunal. **Matrimony Vine.**
Common about old gardens.

1027. **Datura** *Stramonium*, L. **Jamestown Weed.**
Common Northwest.

1028. *Tatula*, L.
Common.

1029. **Nicotiana** longiflora. **Wild Tobacco.**
Jackson, (Mann).

SCROPHULARIACEÆ.

Figwort Family.

1030. **Verbascum** *Blattaria*, L. **Moth Mullein.**
Common along roadsides.

1031. *Thapsus*, L. **Mullein.**
Common in old fields.

1032. **Linaria** *Elatine*, Miller. **Toad Flax.**
St. Louis, along Mo. Pac. R. R. (Letterman).

1033. *vulgaris*, Miller. Butter-and-eggs.
Common.

1034. **Collinsia** verna, Nutt.
Common.

1035. violacea, Nutt.
Bates & Jasper, (Broadhead).

1036. **Scrophularia** nodosa, L., var. Marilandica, Gray. Figwort.
Common.

1037. **Chelone** glabra, L. Snake-head.
Pike, (Pech), St. Louis, (Letterman).

1038. **Pentstemon** gracilis, Nutt. Beardtongue.
Greene, (Shepard).
1039. grandiflorus, Nutt.
Atchison, (Broadhead).
1040. lævigatus, Solander
Banks of Mississippi River.
1041. var. Digitalis, Gray.
Common.
1042. pubescens, Solander.
Common Eastward, rare Westward.
1043. **Mimulus** alatus, Solander. Monkey Flower.
Common.
1044. Jamesii, T. & G.
Greene, (Shepard).
1045. ringens, Gray.
Boone & St. Louis. (Tracy), Jackson, (Bush).
1046. **Conobea** multifida, Benth.
Jackson, (Bush), Pike, (Pech), St. Louis, (Riehl).
1047. **Herpestis** rotundifolia, Pursh.
Cass, (Broadhead), Jackson, (Bush).
1048. **Gratiola** aurea, Muhl. Hedge Hyssop.
St. Louis, (Geyer).
1049. sphærocarpa, Ell.
Jackson, (Bush).
1050. Virginiana, L.
Cass & Knox, (Broadhead), Pike, (Pech), Randolph, (Bush).
1051. **Ilysanthes** gratioloides, Benth. False Pimpernel.
Common.
1052. **Limosella** aquatica, L. Mudwort.
Jackson, (Bush).
1053. **Veronica** *agrestis*, L. Field Speedwell.
St. Louis, (Tracy).
1054. Anagallis, L. Water Speedwell.
Greene, (Shepard), Jackson, (Bush).
1055. *arvensis*, L. Corn Speedwell.
Common.
1056. peregrina, L. Purslane Speedwell.
Very common in cultivated ground.
1057. serpyllifolia, L. Thyme-leaved Speedwell.
Boone, (Tracy), Marion, (Broadhead), Pike, (Pech).
1058. Virginica, L. Culver's Physic.
Common.

1059. **Buchnera** Americana, L. Blue Hearts.
Barton & Bates, (Broadhead), Greene, (Shepard), St. Louis, (Riehl).

1060. **Seymeria** macrophylla, Nutt. Mullein Foxglove.
Boone & St. Louis, (Tracy), Cass, (Broadhead), Jackson, (Bush).

1061. **Gerardia** auriculata, Michx. Gerardia.
Cass, (Broadhead), Jackson, (Bush), St. Louis, (Murtfeldt).

1062. flava, L. Downy Foxglove.
Pike, (Pech), Wright, (Bush).

1063. grandiflora, Benth.
Greene, (Shepard), Miller, (Winick).

1064. pedicularia, L.
Greene, (Shepard).

1065. purpurea, L. Purple Gerardia.
Common.

1066. quercifolia, Pursh. Smooth Foxglove.
Osage, (Swallow), Pike, (Pech).

1067. setacea, Walt.
Wright, (Bush).

1068. Skinneriana, Wood.
Jackson, (Bush).

1069. tenuifolia, Vahl. Slender Gerardia.
Common.

1070. **Castilleia** coccinea, Spreng. Painted Cup.
Common everywhere.

1071. sessiliflora, Pursh.
Greene, (Shepard).

1072. **Pedicularis** Canadensis, L. Lousewort.
Common in rich woods.

1073. lanceolata, Michx.
Greene, (Shepard).

OROBANCHACEÆ.

Broomrape Family.

1074. **Aphyllon** uniflorum, T. & G. One Flowered Cancer-Root.
Common.

1075. **Epiphegus** Virginiana, Bart. Cancer Root.
Missouri, (Meehan).

LENTIBULACEÆ.

Bladderwort Family.

1076. **Utricularia** minor, L. Small Bladderwort.
St. Louis, (Riehl).
1077. vulgaris, L. Great Bladderwort.
Common in ponds.

BIGNONIACEÆ.

Bignonia Family.

1078. **Bignonia** capreolata, L.
Common Southeast.
1079. **Tecoma** radicans, Juss. Trumpetvine.
Common South of Pike, Boone, Pettis and Bates.
1080. **Catalpa** bignonioides, Walt. Common Catalpa.
Common.
1081. speciosa, Warder. Hardy Catalpa.
Undoubtedly indigenous along Black River where Letterman procured logs three feet in diameter. Also found frequently in other localities, where perhaps it has been planted.

PEDALIACEÆ.

1082. **Martynia** proboscidea, Glox. Unicorn Plant.
Common.

ACANTHACEÆ.

Acanthus Family.

1083. **Calophanes** oblongifolia, Don.
St. Louis, (Riehl).
1084. **Ruellia** ciliosa, Pursh.
Common.
1085. var. longiflora, Gray.
Jackson, (Bush), St. Louis, (Murtfeldt).
1086. strepens, Nees.
Common from Pike and Cass Southward.
1087. **Dianthera** Americana, L. Water Willow.
Common.

VERBENACEÆ.

Vervain Family.

1088. **Phryma** Leptostachya, L. Lopseed.
Common in rocky woods.

1089. **Verbena** angustifolia. Michx. Narrow-leaved Vervain.
Common on dry hills.

1090. Aubletia, L.
Common South and West.

1091. bracteosa, Michx.
Common along roadsides.

1092. hastata, L. Blue Vervain.
Common in waste places.

1093. *officinalis*, L. European Vervain.
Mississippi, (Galloway), Pike, (Pech).

1094. stricta, Vent. Hoary Vervain.
Common.

1095. urticifolia, L. White Vervain.
Common along roadsides.

1096. **Lippia** lanceolata, Michx. Fog-fruit.
Common.

1097. nodiflora, Michx.
St. Louis, (Riehl).

1098. **Callicarpa** Americana, L. French Mulberry.
Miller, (Winick).

LABIATÆ.

Mint Family.

1099. **Trichostema** dichotomum, L. Blue Curls.
St. Louis, (Riehl).

1100. **Isanthus** cæruleus, Michx. False Pennyroyal.
Common on barrens.

1101. **Teucrium** Canadense, L, Wood Sage.
Common everywhere.

1102. **Collinsonia** Canadensis, L. Horse Balm.
Iron and Wayne, (Letterman).

1103. **Mentha** Canadensis, L. Wild Mint.
Common on low grounds.

1104. var. glabrata, Benth.
Jackson, (Bush).

1105. *piperita*, L. Peppermint.
Common about gardens.

1106. *viridis*, L. Spearmint.
Jackson, (Bush), St. Louis, (Murtfeldt).

1107. **Lycopus** rubellus, Mœnch. Water Horehound.
Greene, (Shepard).

1108. sinuatus, Ell.
Common.

1109. Virginicus, L.
Common on river bottom lands.

1110. **Cunila** Mariana, L. Dittany.
Common from Pike and Callaway South and West.

1111. **Pycnanthemum** lanceolatum, Pursh. Mountain Mint.
Greene, (Shepard), Pike, (Pech).

1112. leptopodon, Gray.
Greene, (Shepard).

1113. linifolium, Pursh.
Common.

1114. muticum, Pers. var. pilosum. Gray.
Greene, (Shepard), Jackson, (Bush).

1115. Torreyi, Benth.
Jackson, (Bush).

1116. **Calamintha** glabella, Benth. Calaminth.
Miller, (Winick).

1117. Nutallii, Benth.
Greene, (Shepard).

1118. **Melissa** *officinalis*, L. Common Balm.
Common.

1119. **Hedeoma** hispida, Pursh. Mock Pennyroyal.
Common in dry, rocky places.

1120. pulegioides, Pers.
Common everywhere.

1121. **Salvia** azurea, Lam. Sage,
Cass, (Broadhead).

1122. var. grandiflora, Benth.
Jackson, (Bush), St. Louis, (Murtfeldt).

1123. lanceolata, Willd.
Common.

1124. lyrata, L. Lyre-leaved Sage.
Cass and St. Charles, (Broadhead), Iron and Wayne, (Letterman), St. Louis, (Murtfeldt).

1125. **Monarda** Bradburiana. Beck. Horse-mint.
Common everywhere.

1126. fistulosa, L. Wild Bergamot.
Common everywhere.

1127. punctata, L. Horse-mint.
Greene, (Shepard), Mississippi, (Galloway), Pettis, (McCluney).

1128. **Blephilia** ciliata, Raf.
Common.

1129. hirsuta, Benth.
Common in damp, open woods.

1130. **Lophanthus** nepetoides, Benth. Giant Hyssop.
Common along fences.

1131. scrophulariæfolius, Benth.
Cass and Jackson, (Broadhead), Pettis, (McCluney).

1132. **Nepeta** *Cataria*, L. Catnip.
Common about old gardens.

1133. *Glechoma*, Benth. Ground Ivy.
Common in damp places.

1134. **Scutellaria** canescens, Nutt. Skullcap.
Common on hillsides.

1135. galericulata, L.
Jackson, (Bush).

1136. lateriflora, L.
Common.

1137. nervosa, Pursh.
Pike, (Pech).

1138. parvula, Michx.
Common everywhere.

1139. pilosa, Michx.
Wright, (Bush).

1140. saxatilis, Riddell.
Miller, (Winick).

1141. versicolor, Nutt.
Common along river banks.

1142. **Brunella** vulgaris, L. Self-heal.
Common in pastures.

1143. **Physostegia** Virginiana, Benth. False Dragon-head.
Common.

1144. var. speciosa, Gray.
Common Westward.

1145. **Marrubium** *vulgare*, L. Horehound,
Common about old gardens.

1146. **Leonurus** *Cardiaca*, L. Motherwort.
Boone, (Tracy), Jackson, (Bush), Pettis, (McCluney), St. Louis, (Riehl).

1147. *Marrubiastrum*, L.
Pike, (Pech).

1148. **Lamium** *amplexicaule*, L. Dead Nettle.
Cass, (Broadhead).

1149. **Stachys** aspera, Michx. Hedge Nettle
Common.

1150. var. glabra, Gray.
Jackson, (Bush).

1151. cordata, Riddell.
Jackson, (Bush).

1152. hyssopifolia, Michx.
"Missouri," (A. Wood)

1153. palustris, L.
Common.

PLANTAGINACEÆ.

Plantain Family.

1154. **Plantago** cordata, Lam. Plantain.
Not rare.

1155. heterophylla, Nutt.
Boone, (Tracy).

1156. *lanceolata*, L. Ribgrass.
Boone, (Tracy), Jackson, (Bush).

1157. *major*, L. Common Plantain.
About dooryards everwhere.

1158. Patagonica, Jacq.
Boone (Galloway), St. Louis, (Kellogg).

1159. var. gnaphalioides, Gray.
Clay and Jackson, (Bush).

1160. var. aristata, Gray.
Boone, (Tracy), Jackson,—*rare*—(Bush), Lewis (Egeling), Pike, (Pech).

1161. pusilla, Nutt.
Common.

1162. Rugelii, Decaisne.
Franklin, Jefferson, and St. Louis, (Letterman), Greene, (Shepard).

1163. Virginica, L.
Common.

1164. var. longifolia, Gray.
Jackson, (Bush), St. Louis, (Murtfeldt).

ARISTOLOCHIACEÆ.

Birthwort Family.

1165. **Asarum** Canadense, L. Wild Ginger.
Common in rich woods.

1166. **Aristolochia** Serpentaria, L. Virginia Snakeroot.
Boone (Galloway), Greene and Jackson, (Bush), St. Louis, (Tracy).

1167. Sipho, L'Her. Dutchman's Pipe.
Mississippi, (Galloway).

1168. tomentosa, Sims.
Common Southward.

NYCTAGINACEÆ.

Four o'clock Family.

1169. **Oxybaphus** albidus, Sweet.
Jackson, (Bush).

1170. angustifolius, Sweet.
Common Westward.

1171. hirsutus, Sweet.
Jackson, (Bush).

1172. nyctagineus, Sweet.
Common.

PHYTOLACCACEÆ.

Poke Family.

1173. **Phytolacca** decandra, L. Poke-root.
Common in rich soil.

CHENOPODIACEÆ.

Goosefoot Family.

1174. **Cycloloma** platyphyllum, Moquin. Winged Pigweed.
Clay and Jackson, (Bush), Franklin and St. Louis along Meramec River, (Letterman).

1175. **Chenopodium** *album*, L. Pigweed.
Common everywhere.

1176. var. viride, L.
Jackson, (Bush), Pike, (Pech).

1177. *ambrosioides*, L. Mexican Tea.
Common.

1178. var. *anthelminticum*, Gray. Wormseed.
Jackson, (Bush), St. Louis, (Riehl).

1179. *Boscianum*, Moq.
Jackson, (Bush).

1180. *Botrys*, L. Jerusalem Oak.
Along river bottoms.

1181. capitatum, Watson. Strawberry Blite.
Boone, (Tracy).

1182. *hgbridum*, L. Maple-leaved Goosefoot.
Common.

1183. *murale*, L.
Jackson, (Bush).

1184. urbicum, L.
Common.

AMARANTACEÆ.

Amaranth Family.

1185. **Amarantus** *albus*, L, Pigweed.
Boone, (Tracy), Jackson, (Bush), St. Louis, (Murtfeldt).

1186. Blitum, L.
Cass, (Broadhead).

1187. hybridus, L.
Common.

1188. *hypochondriacus*, L. Red Amaranth.
Boone, (Tracy), Pike, (Pech).

1189. *paniculatus*, L.
Jackson, (Bush).

1190. *retroflexus*, L.
Jackson, (Bush).

1191. *spinosus* L. Thorny Amaranth.
Common everywhere.

1192. **Acnida** rusocarpa, Gray. Water-leaf.
Jackson, (Bush).

1193. tuberculata, Gray.
Jackson, (Bush).

1194. **Iresine** celosioides, L.
Butler, Jefferson and St. Louis, (Letterman).

POLYGONACEÆ.

Buckwheat Family.

1195. **Rumex** *Acetosella*, L. Sheep Sorrel.
Common everywhere.

1196. Britannica, L. Pale Dock.
Greene, (Shepard), Jackson, (Bush), Pike, (Pech).

1197. *conglomeratus*, Murr. Small Green Dock.
Boone, (Galloway), Pike, (Pech).

1198. *crispus*, L. Curled Dock.
Common.

1199. Engelmanni, Ledeb.
"Missouri," (A. Wood).

1200. maritimus, L. Golden Dock.
Along Missouri river.

1201. *obtusifolius*, L Bitter Dock.
Common.

1202. Salicifolius, Weinm. White Dock.
Jackson, (Bush).

1203. verticillatus, L. Swamp Dock.
St. Louis, (Kellogg).

1204. **Polygonum** acre, H. B. K. Water Smartweed.
Common.

1205. amphibium,L. Water Persicaria.
Cass, (Broadhead).

1206. arifolium, L. Halberd-leaved Tear-thumb.
Greene, (Shepard).

1207. aviculare, L. Goose-grass.
Common about door-yards.

1208. *Convolvulus*, L. Black Bindweed.
Common.

1209. dumetorum, L. Climbing False Buckwheat.
Common.

1210. var. scandens, Gray.
Jackson, (Bush).

1211. erectum, L.
Boone, (Tracy), Jackson, (Bush), Pike, (Pech).

1212. Hydropiper, L. Common Smartweed.
Common everywhere.

1213. hydropiperoides, Michx. Wild Water Pepper.
Common.

1214. incarnatum, Ell.
Boone, (Tracy), Jackson, (Bush), Pike, (Pech).

1215. Muhlenbergii, Watson.
Jackson, (Bush).

1216. *orientale*, L. Princes' Feather.
Escaped from gardens.

1217. Pennsylvanicum, L.
Common.

1218. *Persicaria*, L. Lady's Thumb.
Boone, (Tracy), Jackson, (Bush) St. Louis, (Murtfeldt).

1219. ramosissimum, Michx.
Common.

1220. sagittatum, L. Arrow-Leaved Tear-Thumb.
Pike, (Pech), St. Francois, (Galloway).

1221. tenue, Michx.
Greene, (Shepard).

1222. Virginianum, L.
Common.

1223. **Fagopyrum** *esculentum*, Mœnch. Buckwheat.
Occasionally escaped.

LAURACEÆ.

Laurel Family.

1224. **Sassafras** officinale, Nees. Sassafras.
Common, except Northwest. A tree cut by Galloway in Mississippi county, was 125 feet high to where the top had been broken off, and measured eighteen feet in circumference at seven feet above the ground.

1225.	**Lindera** Benzoin, Meisner. Common.	Spice Bush.
1226.	melissæfolia, Blume. Greene, (Shepard).	

THYMELEACEÆ.

Mezereum Family.

1227.	**Dirca** palustris, L. Common Eastward.	Leatherwood.

ELÆAGNACEÆ.

Oleaster Family.

1228.	**Shepherdia** argentea, Nutt. " Missouri," (A. Wood).	Buffalo Berry.

SANTALACEÆ.

Sandalwood Family.

1229.	**Comandra** umbellata, Nutt. Common.	Bastard Toad-flax.

LORANTHACEÆ.

Mistletoe Family.

1230.	**Phoradendron** flavescens, Nutt. Common in extreme Southeast.	American Mistletoe.

SAURURACEÆ.

Lizzard's-Tail Family.

1231.	**Saururus** cernuus, L. Common.	Lizzard's Tail.

CERATOPHYLLACEÆ.

Hornwort Family.

1232. **Ceratophyllum** demersum; L. Hornwort.
Jackson, (Bush), Pike, (Pech).

CALLITRICHACEÆ.

Water Starwort Family.

1233. **Callitriche** Austini, Engelm. Water Starwort.
"Missouri," (Gray's Manual, 5th Ed).
1234. heterophylla, Pursh.
Greene, (Shepard).
1235. verna, L.
Jackson, (Bush), Pike, (Pech).

EUPHORBIACEÆ.

Spurge Family.

1236. **Euphorbia** commutata, Engelm.
Franklin, Jefferson & St. Louis, (Letterman).
1237. corollata, L.
Common.
1238. dentata, Michx.
Common.
1239. dictyosperma, F. & M.
Clay & Jackson, (Bush).
1240. discoidalis, Chapm.
Franklin, Jefferson & St. Louis, (Letterman).
1241. Geyeri, Engelm,
Jackson, (Bush).
1242. heterophlla, L.
Boone, (Tracy), Jackson, (Bush), Pike, (Pech).
1243, humistrata, Engelm.
Common.
1244. hypericifolia, L.
Common.
1245. maculata.
Common.

1246. *marginata*, Pursh.
Introduced from the West.

1247. obtusata, Pursh.
Pike, (Pech).

1248. petaloidea, Engelm.
Cass, (Broadhead).

1249. serpens, M. B. K.
Common.

1250. serpyllifolia, Pers.
Miller, (Winick).

1251. **Croton** capitatus, Michx.
Common.

1252. glandulosus, L.
Franklin, Jefferson & St. Louis, (Letterman), Greene, (Shepard).

1253. monanthogynus, Michx.
Common.

1254. Texensis, Mull.
Jackson, (Bush),

1255. **Acalypha** Virginica, L. Three-seeded Mercury.
Common.

1256. var. gracilens, Gray.
Jackson, (Bush).

1257. Caroliniana, Walt.
Greene, (Shepard), Pike, (Pech).

1258. **Ricinus** *communis*, L. Castor Bean.
Occasionally persistent about gardens.

1259. **Sebastiana** ligustrina, Mull.
St. Louis, (Geyer).

1260. **Tragia** macrocarpa, Willd.
Henry, (Bush).

1261. urticæfolia, Michx.
Greene, (Shepard), Miller, (Winick).

1262. **Crotonopsis** linearis, Michx.
Franklin, Jefferson and St. Louis, (Letterman).

URTICACEÆ.

Nettle Family.

1263. **Ulmus** alata, Michx. Winged Elm.
Common from Callaway and Cole Southeast.

1264. Americana, L. White Elm.
Common everywhere.

1265. fulva, Michx. Slippery Elm.
Common.

1266. racemosa, Thomas. Corky White Elm.
Boone, (Tracy), Jackson, (Bush).

1267. **Celtis** occidentalis, L. Hackberry.
Common.

1268. **Morus** rubra, L. Red Mulberry.
Common.

1269. *alba*, L.
Occasionally escaped.

1270. **Maclura** aurantiaca.
Newton, (Swallow), Spring river, (Tracy).

1271. **Urtica** *dioica*, L. Stinging Nettle.
Common.

1272. gracilis, Ait.
Common on moist ground.

1273. **Laportea** Canadensis, Gaudich. Wood Nettle.
Common.

1274. **Pilea** pumila, Gray. Clearweed.
Common in shady places.

1275. **Bœhmeria** cylindrica, Willd. False Nettle.
Boone, (Tracy), Jackson, (Bush), Pike, (Pech).

1276. **Parietaria** Pennsylvanica, Muhl. Pellitory.
Common on rocky banks.

1277. **Cannabis** *sativa*, L. Hemp.
Common.

1278. **Humulus** Lupulus, L. Hops.
Common.

PLATANACEÆ.

Sycamore Family.

1279. **Platanus** occidentalis, L. Sycamore.
Common along streams.

JUGLANDACEÆ.

Walnut Family.

1280. **Juglans** cinerea, L. Butternut.
Common except West and Northwest.

1281. nigra, L. Black Walnut.
Common.

1282. **Carya** alba, Nutt. Shell-bark Hickory.
Common.

1283. amara, Nutt. Bitter-nut Hickory.
Common.

1284. aquatica, Nutt.
Butler and common in low lands Southeast, (Letterman).

1285. olivæformis, Nutt. Pecan.
Common along rivers except in Northwest.

1286. porcina, Nutt. Pig-nut Hickory.
Common.

1287. sulcata, Nutt. Large Shell-bark Hickory.
Common along streams.

1288. tomentosa, Nutt. Mockernut.
Common except West and Northwest.

——? From four localities in the State I have received nuts which are apparently from a hybrid of C. alba and C. olivæformis. They are certainly different from any recognized species, but more study is necessary to determine their true relationship. (Tracy).

CUPULIFERÆ.

Oak Family.

1289. **Quercus** alba, L. White Oak.
Common except West of the Nodaway River.

1290. aquatica, Catesby. Water Oak.
Common Southeast.

1291. bicolor, Willd. Swamp White Oak.
Common except in extreme Northwest.

1292. Catesbæi, Michx.
"Missouri," (Engelmann).

1293. cinerea, Michx. Upland Willow Oak.
(Swallow in Geol. Survey Rep.)

1294. coccinea, Wang. Scarlet Oak.
Common.

1295. falcata, Michx. Spanish Oak.
Common Southward.

1296. heterophylla, Michx. Bartram Oak.
Cooper, DeKalb, Shelby and Sullivan, (Broadhead), Pettis, (Swallow).

1297. imbricaria, Michx. Laurel Oak.
Boone, (Tracy), Miller, (Swallow), St. Louis to Butler, (Letterman).

1298. Leana, Nutt. Lea's Oak.
Butler, St. Louis and Washington, rare, (Letterman). Pettis, (Swallow.)

1299. lyrata, Walt.
Common in Butler and swamps of S. E. Mo. Six trees found near Allenton in 1883, the first time observed so far North, (Letterman).

1300. macrocarpa, Michx. Bur Oak.
Low lands South and on high lands North.

1301. Michauxii, Nutt. Cow Oak.
Butler and swamps of Southeast, (Letterman).

1302. Muhlenbergii, Engelm. Chestnut Oak.
Common.

1303. nigra, L. Black-jack Oak.
Common.

1304. obtusiloba, Michx. Post Oak.
Not West of Liberty and Maryville. Common elsewhere. (Broadhead).

1305. palustris, Du Roi. Pin Oak.
Common except Northwest.

1306. Phellos, L. Willow Oak.
Common Southeast.

1307. prinoides, Willd.
Common Northwest.

1308. rubra, L. Red Oak.
Common.

1309. var. runcinata, Engelm.
Miller, (Swallow), St. Louis, (Engelmann).

1310. tinctoria, Bart. Black Oak.
Common.

1311. tridentata, Engelm.
St. Louis, (Engelmann).

1312. quinqueloba, Engelm.
St. Louis, (Engelmann).

1313. **Castanea** pumila, Michx. Chinquapin.
Barry, Cedar and Jasper, (Broadhead).

1314. vulgaris, var. Americana, Walt. Chestnut.

Swallow reports one large tree in New Madrid.

1315. **Fagus** ferruginea, Ait. Beech.

In Southeast only.

CORYLACEÆ.

Hazel Family.

1316. **Ostrya** Virginica, Willd. Hop Tree.

Common.

1317. **Carpinus** Caroliniana, Walt.

Common except Northwest.

1318. **Corylus** Americana, Walt. Hazel Nut.

Common.

BETULACEÆ.

Birch Family.

1319. **Betula** alba, var. populifolia, Sp. White Birch.

Common along streams.

1320. nigra, L. Red Birch.

Common except Westward.

1321. **Alnus** incana, Willd. Speckled Alder.

Mississippi, (Galloway).

1322. serrulata, Ait. Smooth Alder.

Common except Northwest.

SALICACEÆ.

Willow Family.

1323. **Salix** *alba*, L. White Willow.

Introduced.

1324. var. vitellina, Gray. Golden Willow.

Introduced.

1325. amygdaloides, And.

Jackson, (Bush).

1326. candida, Willd. Hoary Willow.

Iron, (Broadhead.)

1327. cordata, Muhl. Heart-leaved Willow.
(Watson in King's 5th Report).
1328. var. rigida, Muhl.
St. Louis, (Geyer).
1329. var. angustata, And.
Putnam, (Swallow).
1330. discolor, Muhl. Glaucous Willow.
Greene, (Shepard), Southern Mo., (Sargent).
1331. humilis, Marsh. Prairie Willow.
Boone, (Tracy), Greene, (Shepard), Jackson, (Bush), St. Louis, (Geyer).
1332. longifolia, Muhl. Long-leaved Willow.
Boone, (Tracy), Jackson, (Bush), Putnam, (Swallow).
1333. lucida, Muhl. Shining Willow.
Jackson, (Bush).
1334. nigra, Marsh. Black Willow.
Common.
1335. petiolaris, Smith. Petioled Willow.
Jackson, (Bush).
1336. sericea, Marsh. Silky Willow.
Jackson, (Bush), St. Louis, (Murtfeldt).
1337. tristis, Ait. Dwarf Gray Willow.
Pike, (Pech).
1338. **Populus** alba, L. Silver Poplar.
Introduced.
1339. angulata, Ait. Angled Cottonwood.
Jackson, (Bush).
1340. balsamifera, L. Balsam Poplar.
Boone, (Galloway).
1341. grandidentata, Michx. Large-toothed Aspen.
Boone, (Tracy), Wright, (Bush).
1342. heterophylla, L. Downy Poplar.
Common Southeast.
1343. monilifera, Ait. Cottonwood.
Common, especially Northwest.
1344. tremuloides, Michx. American Aspen.
Common Northward.

CONIFERÆ.

Pine Family.

1345. **Juniperus** communis, L. Juniper
Greene, (Shepard).

1346. Virginiana, L. Red Cedar.
Common on hilly woodlands.

1347 **Pinus** mitis, Michx. Yellow Pine.
Letterman reports this from nineteen counties in the Ozark region.

1348. **Taxodium** distichum, Richard. Cypress.
Common in the swamps of the Southeast.

ARACEÆ.

Arum Family.

1349. **Arisæma** Dracontium, Schott. Dragon Root.
Boone and St. Louis, (Tracy), Jackson, (Bush).

1350. triphyllum, Torr. Indian Turnip.
Common.

1351. **Orontium** aquaticum, L. Golden Club.
Boone, (Tracy).

1352. **Acorus** Calamus, L. Sweet Flag.
Common.

LEMNACEÆ.

Duckweed Family.

1353. **Lemna** gibba, L.
Pike, (Pech).

1354. paucicostata, Hegel.
Jackson, (Bush), St. Louis, (Gray).

1355. Torreyi, Austin.
(Gray's Manual, 5th Ed).

1356. **Speirodela** polyrrhiza, Schleid.
Cass, (Broadhead), Jackson, (Bush), Pike, (Pech).

TYPHACEÆ.

Cat-tail Family.

1357. **Sparganium** eurycarpum, Engelm. Bur-reed.
Common.

1358. var. androcladum, Gray.
Greene, (Shepard).
1359. var. Nuttallii, Gray.
Cass, (Broadhead).
1360. **Typha** angustifolia, L. Narrow-leaved Flag.
The most common species Westward.
1361. latifolia, L. Common Cat-tail Flag.
Common elsewhere, but rare Westward.

NAIADACEÆ.

1362. **Naias** Indica, var. grabillima, Braun.
" Missouri," (Engelmann).
1363. **Zannichella** palustris, L.
Pike, (Pech).
1364. **Potamogeton** hybridus, Michx. Pond Weed.
Boone. (Tracy), Jackson, (Bush), Perry, (Demetrio).
1365. var. spicatus, Engelm.
St. Louis, (Geyer).
1366. natans, L.
Common.
1367. pulcher, Tuck.
St. Louis, (Engelmann).
1368. pusillus, L.
Jackson, (Bush), Perry, (Demetrio).
1369. Spirillus, Tuck.
Boone, (Tracy).

ALISMACEÆ.

Water Plantain Family.

1370. **Alisma** Plantago, L., var. Americanum, Gr. Water-Plantain.
Common.
1371. **Echinodorus** parvulus, Engelm.
" Missouri," (A. Wood).
1372. radicans, Engelm.
Pike, (Pech).
1373. rostratus, Engelm.
Jackson, (Bush).
1374. **Sagittaria** calycina, Engelm. Arrowhead.
Greene, (Shepard).

1375. graminea, Michx.
Jackson, (Bush), Pike, (Pech).
1376. heterophylla, Pursh.
Jackson, (Bush), Pike, (Pech).
1377 lancifolia, L.
Putnam, (Swallow), St. Louis, (Tracy).
1378. variabilis, Engelm.
Common.
1379. uligniosum, Engelm.
St. Louis, (Engelmann).

HYDROCHARIDACEÆ.

Frog's bit Family.

1380. **Limnobium** Spongia, Richard. — Frog's-bit.
Marion, (Swallow).
1381. **Anacharis** Canadensis, Planchon. — Water Weed.
Jackson, (Bush).
1382. **Vallisneria** spiralis, L. — Eel Grass.
St. Louis, (Tracy).

ORCHIDACEÆ.

Orchis Family.

1383. **Orchis** spectabilis. — Showy Orchis.
Boone, (Tracy), Greene, (Shepard), Perry (Demetrio), Pike, (Pech).
1384. **Habenaria** cristata, R. Br. — Rein Orchis.
Perry, (Demetrio).
1385. lacera, R. Br. — Ragged Fringed Orchis.
Pike, (Pech).
1386. leucophæa, Gray.
Cass, (Broadhead). Jackson, Bush).
1387. virescens, Spreng.
Miller, (Winick), Ralls, (Broadhead), St. Louis, (Letterman).
1388. **Spiranthes** cernua, Richard. — Ladies' Tresses.
Jackson and Wright, (Bush), Mississippi, (Galloway), Pike, (Pech).

1389. gracilis, Big.
Boone, (Galloway), Jackson and Wright, (Bush).

1390. graminea, Lindl., var. Walteri. Gray.
Not rare Southward.

1391. **Pogonia** pendula, Lindl.
Clay, (Mann), Jackson, (Bush), Pike, (Pech).

1392. **Calopogon** pulchellus, Nutt.
Greene, (Shepard).

1393. **Bletia** aphylla, Nutt.
St. Louis, near Allenton, rare, (Letterman).

1394. **Microstylis** ophioglossoides, Nutt. Adder's Mouth.
Pike, (Pech).

1395. **Liparis** liliifolia, Richard. Twayblade.
Greene, (Shepard), Marion, (Swallow), Miller, (Winick), Pike, (Pech).

1396. **Corallorhiza** multiflora, Nutt. Coral-root.
St. Louis, (Letterman).

1397. odontorhiza, Nutt.
Pike, (Pech), St. Louis, (Kellogg).

1398. striata, Lindl.
Perry, (Demetrio).

1399. **Applectrum** hyemale, Nutt. Putty-root.
Boone, (Tracy), Jackson, (Bush), Jefferson and St Louis, (Letterman). Rare.

1400. **Cypripedium** candidum, Muhl. White Lady's Slipper.
Common.

1401. parviflorum, Salisb. Small Yellow Lady's Slipper.
Common.

1402. pubescens, Willd. Large Yellow Lady's Slipper.
Common.

1403. spectabile, Swartz. Showy Lady's Slipper.
Cass, Linn and Mercer, (Broadhead), Putnam, (Swallow).

AMARYLLIDACEÆ.

Amaryllis Family.

1404. Hymenocallis maritimum.
Butler, (Letterman).

1405. **Agave** Virginica, L. False Aloe.
Madison, (Broadhead), Wright, (Bush).

1406. **Hypoxys** erecta, L. Star Grass.
Common everywhere.

IRIDACEÆ.

Iris Family.

1407. **Iris** cuprea, Pursh. Yellow Iris.
Jackson, (Frye).
1408. versicolor, L. Large Blue Flag.
Common.
1409. Virginica, L. Slender Blue Flag.
St. Louis, (Letterman).
1410. **Pardanthus** *Chinensis*, Ker. Blackberry Lily.
Common about old gardens.
1411. **Sisyrinchium** anceps, L. Blue-eyed Grass.
Common everywhere.
1412. **Nemastylis** gemmiflora.
" Missouri," (T. Gardner).

DIOSCOREACEÆ.

Yam Family.

1413. **Dioscorea** villosa, L. Wild Yam.
Common.

SMILACEÆ.

Smilax Family.

1414. **Smilax** glauca, Walt. Greenbrier.
" Missouri," (Swallow).
1415. herbacea L. Carrion Flower.
Common.
1416. var lasioneuron, Hook.
Montgomery, (Broadhead).
1417. var. pulverulenta, Gray.
Jackson, (Bush).
1418. hispida, Muhl.
Boone, (Tracy), Callaway, (Broadhead), Greene, (Shepard), Pike, (Pech).

1419. Pseudo-China, L.
Boone, (Galloway,) Pemiscot, (Swallow).

1420. rotundifolia, L.
Common.

1421. tamnifolia, Michx.
"Missouri," (Swallow).

1422. tamnoides, L.
Mississippi, (Galloway).

LILIACEÆ.

Lily Family.

1423. **Allium** Canadense, Kalm. — Wild Garlic.
Common.

1424. cernuum, Roth. — Wild Onion.
Common.

1425. mutabile, Michx.
Jackson, (Bush).

1426. stellatum, Nutt.
Greene and Jackson, (Bush).

1427. **Northoscordum** striatum, Kunth.
Common.

1428. **Muscari** *botryoides* Mill. — Grape Hyacinth.
Escaped from gardens.

1429. **Camassia** Fraseri, Torr. — Squill.
Common.

1430. **Polygonatum** biflorum, Ell. — Small Solomon's Seal.
Common.

1431. giganteum, Dietrich. — Great Solomon's Seal.
Common.

1432. latifolum, Desf.
Pike, (Pech).

1433. **Asparagus** *officinalis*, L. — Asparagus.
Escaped from gardens.

1434. **Smilacina** racemosa, Desf. — False Spikenard.
Common

1435. stellata, Desf. — False Solomon's Seal.
Pike, (Pech), St. Louis, (Tracy).

1436. **Yucca** angustifolia, Pursh. — Bear Grass.
Atchison, (Broadhead).

1437. **Lilium** Canadense, L. Wild Yellow Lily.

Cass and Iron, (Broadhead), Pike, (Pech).

1438. Catesbæi, Walt. Southern Red Lily.

Clark, (Broadhead).

1439. Philadelphicum, L. Wild Orange-red Lily.

Common.

1440. superbnm, L. Turks-cap Lily.

Jackson, (Bush), St. Louis, (Murtfeldt).

1441. var. Carolinianum, Chapm.

Jackson, (Bush).

1442. **Erythronium** albidum, Nutt. White Dog-tooth Violet.

Common.

1443. Americanum, Smith. Yellow Adder's Tongue.

Knox, (Linn), Pettis, (McCluney).

1444. **Ornithogalum** *umbellatum*, L. Star-of-Bethlehem.

About old gardens.

1445. **Uvularia** grandiflora, Smith. Bellwort.

Boone & St. Louis, (Tracy), Jackson, (Bush).

1446. perfoliata, L.

Common in rich woods.

1447. **Trillium** cernuum, L. Nodding Trillium.

St. Charles, (Broadhead).

1448. erythrocarpum, Michx. Painted Trillium.

Pike, (Pech).

1449. erectum, L. Purple Trillium.

Boone, (Galloway), St. Charles and St. Louis, (Broadhead).

1450. grandiflorum, Salisb. Large White Trillium.

St. Louis, (Kellogg).

1451. recurvatum, Beck.

St. Charles, (Broadhead).

1452. sessile, L.

Common.

1453. **Melanthium** Virginicum, L. Bunch-flower.

Common.

1454. **Veratrum** viride, Ait. Indian Poke.

Boone, (Tracy).

1455. Woodii, Robbins.

Pike, (Pech in 1842). Abundant along the Meramec in Jefferson county, "now the only known locality," (Letterman).

1456. parviflorum, Michx.
Marion (Swallow), Pike, (Broadhead).

1457. **Zygadenus** glaberrimus, Michx.
St. Louis, (Murtfeldt).

1458. **Tofieldia** glabra, Nutt. False Asphodel.
Miller, (Winick).

JUNCACEÆ.

Rush Family.

1459. **Luzula** campestris, DC.
Boone, (Tracy).

1460. **Juncus** acuminatus, Mich. Rush.
St. Louis, (Murtfeldt).

1461. var. debilis, Engelm.
Jackson, (Bush).

1462. var. robustus, Engelm.
"Missouri," (Engelmann).

1463. var. legitimus, Engelm.
Jackson, (Bush).

1464. brachycarpus, Engelm.
Vernon, (Broadhead).

1465. marginatus, Rosth.
Miller, (Winick), Vernon, (Broadhead).

1466. nodosus, L.
Common.

1467. var. megacephalus, Torr.
Jackson, (Bush).

1468. scirpoides, Lam.
Pike, (Pech).

1469. var. polycephalus, Engelm.
St. Louis, (Riehl).

1470. setaceus, Rostk.
Pike. (Broadhead).

1471. tenuis, Willd.
Common.

PONTEDERIACEÆ.

Pickerel weed Family.

1472. **Pontederia** cordata, L. Pickerel Weed.
Common.

1473. **Heteranthera** graminea. Water Star-grass.
Maries, (Broadhead), Pike, (Pech).
1474. limosa, Vahl. Mud Plaintain.
Jackson, (Bush).

COMMELYNACEÆ.

Spiderwort Family.

1475. **Commelyna** Virginica, L. Day Flower.
Common.
1476. hirtella, Vahl.
Mississippi, (Galloway).
1477. Cayennensis, Richard.
Mississippi, (Galloway).
1478. **Tradescantia** rosea, Vent. Spiderwort.
Boone, (Tracy), Greene, Ralls and Texas, (Broadhead).
1479. Virginica, L. Common Spiderwort.
Common.
1480. var. flexuosa, Watson.
Common.

XYRIDACEÆ.

Yellow-eyed Grass Family.

1481. **Xyris** flexuosa, Muhl.
Common.

CYPERACEÆ.

Sedge Family.

1482. **Cyperus** acuminatus, Torr.
Cass, (Broadhead), Jackson, (Bush).
1483. compressus, L.
Jackson, (Bush).
1484. dentatus, Torr.
Pike, (Pech).
1485. diandrus, Torr.
Boone, (Tracy), Callaway, (Broadhead), Jackson, (Bush), Pike, (Pech).
1486. Engelmanni, Steud.
Jackson, (Bush).

1487. erythrorhizos, Muhl.
Jackson, (Bush), St. Louis, (Riehl).

1488. filiculmis, Vahl.
Jackson, (Bush), Pike, (Pech).

1489. flavescens, L.
St. Louis, (Riehl).

1490. inflexus, Muhl.
Jackson, (Bush), Pike, (Pech), St. Louis, (Riehl).

1491. Michauxianus, Schult.
Jackson, (Bush).

1492. ovularis, Torr.
St. Louis, (Murtfeldt), Vernon, (Broadhead).

1493. phymatodes, Muhl.
Common.

1494. rotundus, L., var. Hydra, Gray.
St. Louis, (Riehl).

1495. Schweinitzii, Torr.
Jackson, (Bush), St. Louis, (Letterman).

1496. strigosus, L.
Boone, (Tracy), Jackson, (Bush), Vernon, (Broadhead).

1497. tetragonus, Ell.
St. Louis, (Riehl).

1498. **Kyllingia** pumila, Michx.
Jackson, (Bush), Pike, (Peck), St. Louis, (Letterman).

1499. **Dulichium** spathaceum, Pers.
Cass, (Broadhead), Franklin, Jefferson and St. Louis, (Letterman).

1500. **Hemicarpha** subsquarrosa, Nees.
Jackson (Bush).

1501. **Eleocharis** acicularis, R. Br. Spike-Rush.
Jackson, (Bush).

1502. compressa, Sulliv.
Jackson, (Bush), Pike, (Pech).

1503. intermedia, Schultes.
Jackson, (Bush).

1504. obtusa, Schultes.
Common.

1505. palustris, R. Br.
Jackson, (Bush), Pike, (Pech).

1506. tenuis, Schultes.
Jackson, (Bush), St. Louis, (Geyer).

1057. **Scirpus** atrovirens, Muhl. Bulrush.
Jackson, (Bush), Pike, (Pech), St. Louis, (Riehl).

1508. fluviatilis, Gray.
Bates and Jackson, (Bush).

1509. lineatus, Michx.
Common Eastward.

1510. polyphyllus, Vahl.
Pike, (Pech), Vernon, (Broadhead).

1511. pungens, Vahl.
Boone, (Tracy), Jackson, (Bush).

1512. sylvaticus, L.
Pike, (Pech).

1513. supinus L. var. Hallii, Gray.
St. Louis, (Engelmann).

1514. Torreyi, Olney.
Jackson, (Bush).

1515. validus, Vahl.
Jackson, (Bush), Pike, (Pech).

1516. **Eriophorum** gracile, Koch. Cotton Grass.
Pike, (Pech).

1517. **Fimbristylis** autumnalis, R. & S.
Common.

1518. capillaris, Gray.
Common Eastward.

1519. spadicea. Vahl., var. castanea, Gray.
Jackson, (Bush).

1520. **Rhynchospora** corniculata, Gray. Beak Rush.
Butler, (Letterman).

1521. **Scleria** triglomerata, Michx. Nut Rush.
Jackson, (Bush).

1522. **Carex** aperta, Boott. Sedge.
Jackson, (Bush).

1523. acutiformis, Ehrh.
Jackson, (Bush).

1524. arida, Schw. & Torr.
Pike, (Pech).

1525. aristata, R. Br.
Pike, (Pech).

1526. bromoides, Schk.
Pike, (Pech).

1527. crus-corvi, Shutt.
Bates, (Bush).

1528. conjuncta, Boot.
Jackson, (Bush).

1529. Cherokeensis, Schw.
Missouri, (A. Wood).

1530. cristata, Schw.
Pike, (Pech), St. Louis, (Geyer).

1531. conoida, Schk.
Pike, (Pech).

1532. cephalaphora, Muhl.
Jackson, (Bush), Pike, (Pech).

1533. Davisii, Schw. & Torr.
Jackson, (Bush), Pike, (Pech).

1534. echinata, Murr.
Jackson, (Bush).

1535. eburnea, Boot.
Pike, (Pech).

1536. filiformis, L.
Pike, (Pech).

1537. grisea, Wahl.
Jackson, (Bush).

1538. granularis, Muhl.
Jackson, (Bush).

1539. Hitchcockiana, Dew.
Jackson, (Bush).

1540. hystricina, Willd.
St. Louis, (Riehl).

1541. intumescens, Rudge.
Pike, (Pech).

1542. lagopodioides, Schk.
Jackson, (Bush).

1543. lupulina, Muhl.
Jackson, (Bush), Pike, (Pech).

1544. laxiflora, Lam.
Jackson, (Bush), St. Louis, (Riehl).

1545. var. blanda, Boot.
Jackson, (Bush), Pike, (Pech).

1546. var. intermedia, Boot.
Jackson, (Bush).

1547. var. latifolia, Boot.
Jackson (Bush).

1548. Meadii, Dew.
Jackson, (Bush), St. Louis, (Geyer).

1549. Muhlenbergii, Schk.
Jackson, (Bush), Pike, (Pech).

1550. monile, Tuck.
Jackson, (Bush).

1551. Novæ-Angliæ, Schw.
Pike, (Pech).

1552. oligocarpa, Schk.
Jackson, (Bush), St. Louis, (Riehl).

1553. pubescens, Muhl.
Jackson, (Bush), St. Louis, (Riehl).

1554. Pennsylvanica, Lam.
Jackson, (Bush).

1555. riparia, Curtis,
Jackson, (Bush).

1556. Richardsonii, R. Br.
Jackson, (Bush).

1557. retroflexa, Muhl.
Jackson, (Bush).

1558. rosea, Schk.
Common.

1559. var. minor, Boot.
Jackson, (Bush).

1560. var. radiata, Dew.
Jackson, (Bush), Pike, (Pech).

1561. stenolepis, Torr.
Jackson, (Bush).

1562. Steudelii, Kunth.
Jackson, (Bush).

1563. sparganoides, Muhl.
Jackson, (Bush).

1564. var. minor, Boot.
Jackson, (Bush).

1565. squarrosa, L.
Common.

1566. Shortiana, Dew.
Jackson, (Bush), St. Louis, (Geyer).

1567. straminea, Schck.
Cass, (Broadhead), Jackson, (Bush).

1568. siccata, Dew.
Pike, (Pech).

1569. stipata, Muhl.
Common.

1570. sterilis, Willd.
Jackson, (Bush).

1571. stricta, Lam.
Common.

1572. striata, Michx.
Jackson, (Bush).

1573. trichocarpa, Muhl.
Jackson, (Bush).

1574. Tuckermani, Boot.
Pike, (Pech),

1575. tentaculata, Muhl.
Pike, (Pech).

1576. triceps, Michx.
Common Eastward.

1577. tetanica, Schk.
Jackson, (Bush), St. Louis, (Riehl).

1578. umbellata, Schk.
Common.

1579. virescens, Muhl.
Greene, (Shepard).

1580. vulpinoidea, Michx.
Common.

1581. Vaseyi, Dew.
Jackson, (Bush).

1582. varia, Muhl.
Common Eastward.

1583. Willdenovii, Schck.
St. Louis, (Geyer).

GRAMINEÆ.

Grass Family.

1584. **Paspalum** fluitans, Kth.
Jackson, (Bush).

1585. læve, Michx.
Common.

1586. setaceum, Mich.
Common everywhere.

1587. **Panicum** agrostoides, Muhl. Panic Grass.
Common.

1588. amarum, Ell.
Cass, (Broadhead), Jackson, (Bush).
1589. antumnale, Bosc.
Boone and Mississippi, (Galloway).
1590. capillare, L. Old-witch Grass.
Common everywhere.
1591. clandestinum, L
Common.
1592. crusgalli, L. Barn-yard Grass.
Common everywhere.
1593. var. hispidum, Gray.
Common everywhere.
1594. depauperatum, Muhl.
Common.
1595. dichotomum, L.
Common everywhere.
1596. glabrum, Gaud.
Boone, (Galloway), Jackson, (Bush).
1597. latifolium, Muhl.
Common from Boone Southeast.
1598. microcarpum, Muhl.
Jackson, (Bush), Jefferson, (Tracy), Mississippi, (Galloway).
1599. var. sphærocarpon, Vasey.
Jackson, (Bush).
1600. proliferum, Lam.
Common.
1601. *sanguinale*, L. Crab Grass.
Common.
1602. scoparium, Lam.
Mississippi, (Galloway).
1603. virgatum, L. Switch Grass.
Common along streams.
1604. viscidum, Ell.
Jackson, (Bush).
1605. **Setaria** *glauca*, Beauv. Foxtail.
Common.
1606. *Italica*, Kunth. Millet.
Common in cultivation, occasionally escaped.
1607. verticillata, Beauv. Brown Foxtail.
Common.
1608. viridis, Beauv. Green Foxtail.
Common.

1609. **Cenchrus** tribuloides, L. Sand-bur Grass.
Common Northwest.

1610. **Spartina** cynosuroides, Willd. Cord Grass.
Common in damp soils.

1611. **Coix** *lachryma*, L. Job's Tears.
Cultivated and occasionally persistent.

1612. **Tripsacum** dactyloides, L. Gama Grass.
Cass, (Broadhead), Jackson, (Bush), St. Louis, (Galloway).

1613. **Zizania** aquatica, L. Wild Rice.
Common in swampy lands.

1614. **Leersia** lenticularis, Michx. Fly-catch Grass.
Boone and Mississippi, (Galloway).

1615. oryzoides, Swz. False Rice.
Common.

1616. Virginica, Willd. Cut Grass.
Common.

1617. **Erianthus** saccharoides, Michx.
Occasionally in swampy lands Southeast.

1618. **Andropogon** dissitiflorus, Michx. Blue-joint Grass.
Common.

1619. macrourus, Michx.
Madison, (Broadhead).

1620. provincialis, Lam.
Common.

1621. scoparius, Michx.
Common.

1622. **Chrysopogon** nutans, Benth. Wild Sorghum.
Common.

1623. **Sorghum** *halepense*, L. Guinea Grass, or Johnson Grass.
Introduced and sparingly naturalized.

1624. **Phalaris** arundinacea, L. Reed Canary Grass.
Common.

1625. *Canariensis*, *L.*
Occasional about dwellings.

1626. **Anthoxanthum** odoratum, L. Sweet Vernal Grass.
Common in door-yards.

1627. **Alopecurus** geniculatus, L. Water Fox tail.
Common in cultivated ground.

1628. var. aristulatus, Munro.
Jackson (Bush).

1629. pratensis, L. Meadow Foxtail.

Common from Boone Southwest.

1630. **Aristida** gracilis, Ell. Poverty Grass.

Common in rich soil.

1631. oligantha, Michx.

Common on thin soil.

1632. purpurascens, Poir.

Common along roadsides.

1633. purpurea, Nutt.

Common along roadsides.

1634. ramosissima, Engelm.

Greene, (Bush), Mississippi, (Galloway).

1625. var. uniseta, Engelm.

(Vasey in "Grasses of U. S.")

1636. **Stipa** avenacea, L. Black Oat-Grass.

Livingston, (Galloway).

1637. spartea, Trin. Porcupine Grass.

Cass, (Broadhead).

1638. **Oryzopsis** melanocarpa, Muhl. Mountain Rice.

Pike, (Pech).

1639. **Millium** effusum, L. Millet Grass.

Pike, (Pech).

1640. **Muhlenbergia** capillaris, Kunth. Hair Grass.

Common in Boone, (Galloway).

1641. diffusa, Schreb. Nimble-Will.

Common.

1642. glomerata, Trin.

Howell, (Tracy), Jackson, (Bush), Lafayette, (Galloway).

1643. Mexicana, Trin.

Common.

1644. var. filiformis, Muhl.

With the preceding.

1645. sobolifera, Trin.

Common.

1646. sylvatica, T. & G.

Jackson, (Bush).

1647. Willdenovii, Trin.

Common Westward.

1648. **Brachyletrum** aristatum, Beauv.

Common.

1649. **Phleum** pratense. L. Timothy.
Common in cultivation, and occasionally naturalized.

1650. **Sporobolus** asper, Kunth.
Jackson, (Bush).

1651. cryptandrus, Gray.
Boone, (Galloway), Jackson, (Bush).

1652. heterolepis, Gray.
Common on prairies.

1653. vaginæflorus, Torr.
Common southward.

1654. **Agrostis** elata, Trin. Bent Grass.
Boone, (Galloway), Schuyler, (Tracy).

1655. perennans, Tuck. Twin Grass.
Common.

1656. scabra, Willd. Hair Grass.
Common.

1657. vulgaris, Michx. Red Top.
Common on damp soil.

1658. var. alba, Vasey.
Common.

1659. **Cinna** arundinacea, L. Wood Reed-Grass.
Common.

1660. **Deyeuxia** Canadensis, Beauv. Blue Stem.
Jackson, (Bush), St. Louis, (Galloway).

1661. confinis. Kunth.
Jackson, (Bush), St. Louis, (Galloway).

1662. **Ammophila** longifolia, Benth.
Lafayette, (Galloway).

1663. **Deschampsia** cæspitosa, Beauv.
St. Louis, (Galloway).

1664. flexuosa, Trin.
St. Louis, (Murtfeldt).

1665. **Holcus** lanatus, L.
St. Louis, (Galloway).

1666. **Danthonia** spicata, Beauv.
Common.

1667. **Cynodon** dactylon, Pers.
St. Louis, (Galloway).

1668. **Schedonnardus** Texanus, Steud.
Mississippi, (Galloway).

1669. **Bouteloua** hirsuta, Lag.
Saline, (Galloway).

1670. racemosa, Lag.
Boone, (Galloway), Jackson, (Bush).

1671. **Eleusine** *Indica*, Gaert. Yard Grass.
Common.

1672. **Leptochloa** mucronata, Kunth.
Jackson, (Bush).

1673. **Triodia** sesleroides, Torr.
Common.

1674. **Arundo** *Donax*.
About old gardens.

1675. **Phragmites** communis, Trin. Reed-Grass.
Common Southward in wet places.

1676. **Kœleria** cristata, Pers.
Common.

1677. **Eatonia** obtusata, Gray.
Common.

1678. Pennsylvanica, Gray.
Common.

1679. **Eragrostis** capillaris, L.
Common.

1680. Frankii, Meyer.
Common.

1681. *major*, Host.
Common.

1682. *minor* Host.
Common.

1683. pectinacea, Gray.
Common.

1684. var. spectabilis, Gray.
Boone, (Galloway), Jackson, (Bush).

1685. pilosa, L.
Common.

1686. Purshii, Schrad.
Common.

1687. reptans, Nees.
Boone, (Galloway).

1688. tenuis, Gray.
Boone, (Galloway), Jackson, (Bush).

1689. **Melica** mutica, Walt. Melic Grass.
Common Northward.

1690. **Diahrrhena** Americana, Beauv.
Boone and St. Francois, (Galloway).

1691. **Uniola** latifolia, Michx.
Common in rich woods.

1692. **Dactylis** glomerata, L. Orchard Grass.
Common in cultivation and occasionally naturalized.

1693. **Poa** alsoedes, Gray. Meadow Grass.
Boone, (Galloway),

1694. annua, L, Low Spear Grass.
Common everywhere in cultivated ground.

1695. arachnifera, Torr. Texas Blue Grass.
Introduced from Texas and apparently becoming naturalized.

1696. brevifolia, Muhl.
Boone, (Galloway).

1697. compressa, L. Wire Grass.
Common.

1698. debilis, Torr.
Boone, (Galloway).

1699. flexuosa, Muhl.
Common.

1700. nemoralis, L.
Boone, (Galloway).

1701. pratensis, L. Blue Grass.
Common everywhere.

1703. serotina, Ehrh. Fowl Meadow Grass.
Common.

1704. sylvestris, Gray.
Boone, (Galloway), Jackson, (Bush).

1705. *trivialis*, L. Rough Meadow Grass.
Jackson, (Bush), St. Louis, (Galloway).

1706. **Glyceria** arundinacea, Kunth. Reed Meadow Grass.
Boone, (Galloway).

1707. Canadensis, Trin.
Boone, (Galloway), Jackson, (Bush).

1708. fluitans, R. Br.
Jackson, (Bush).

1709. nervata, Trin.
Common.

1710. **Festuca** duriuscula, L. Fescue.
Boone, (Galloway), Jackson, (Bush).

1711. elatior, L. Meadow Fescue.
Boone, (Galloway).

1712. nutans, Willd.
Common.

1713. *ovina*, L. Sheep's Fescue.
Boone and St. Louis, (Galloway), Jackson, (Bush).
1714. Shortii, Kunth.
(Dr. Vasey in "Grasses of U. S.")
1715. tenella, Willd.
Boone, (Galloway), St. Francois, (Tracy).
1716. **Bromus** ciliatus, L.
Common.
1717. var. purgans, Gray.
Jackson, (Bush).
1718. Kalmii, Gray. Wild Chess.
Boone, (Galloway).
1719. racemosus, L. Upright Chess.
Common.
1720. *secalinus*, L. Cheat or Chess.
Common everywhere.
1721. *sterilis*, L.
Boone, (Galloway).
1722. **Lolium** *perenne*, L. Rye-Grass.
Naturalized.
1723. var. *Italicum*, Vasey. Italian Rye-Grass.
Sparingly naturalized.
1724. **Agropyrum** caninum, R. & S.
Boone, (Galloway).
1725. repens, Beauv. Couch-Grass.
Found occasionally where it has been introduced.
1726. **Hordeum** jubatum, Huds. Squirrel-tail Grass.
Occasional Westward.
1727. pulsillum, Nutt.
Occasional about old gardens.
1728. **Elymus** Canadensis, L. Wild Rye.
Common.
1729. var. glucifolius, Gray.
Common along river banks.
1730. Sitanion, Schultz.
Jackson, (Bush).
1731. striatus. Small Wild Rye.
Common.
1732. var. villosus, Gray.
Jackson, (Bush), St. Francois, (Tracy).
1733. Virginicus, L. Wild Rye.
Common.

1734. **Asprella** hystrix, Willd. Hedge-hog Grass.
Common.

1735. **Arundinaria** tecta, Muhl. Cane.
Common in extreme Southeast.

EQUISETACEÆ.

Horsetail Family.

1736. **Equisetum** arvense, L. Horsetail.
Common.

1737. sylvaticum, L.
Greene, (Shepard).

1738. robustum, Braun,
Jackson, (Bush), St. Louis, (Letterman).

1739. var. affine, Engelm.
Jackson, (Bush).

1740. hyemale, L.
Common.

OPHIOGLOSSACEÆ.

1741. **Ophioglossum** vulgatum, L.
Iron, Jefferson & St. Louis, (Letterman), Jackson, (Bush).

1742. **Botrychium** ternatum, Swz.
Vernon, (Broadhead).

1743. var. lunarioides, Milde.
Common.

1744. Virginianum, Swz.
Butler & St. Louis, (Letterman), Jackson, (Bush).

1745. matricariæfolium, Braun.
Iron, (Broadhead).

FILICES.

Fern Family.

1746. **Polypodium** incanum, Swz.
Mississippi, (Galloway), St. Louis, (Letterman).

1747. vulgare, L.
Boone, (Tracy), Mississippi, (Swallow), St. Louis, (Letterman).

1748. **Notholæana** dealbata, Kunze.
Boone, (Tracy), Jackson, (Bush).

1749. **Adiantum** capillus-veneris, L.
Christian, Greene and Stone, (Shepard), Madison, (Broadhead).

1750. pedatum, L.
Common.

1751. **Pteris** aquilina, L.
Common Southward.

1752. **Cheilanthes** lanuginosa, Nutt.
Common.

1753. tomentosa, Link.
Cole, (Wheeler's Report.).

1754. vestita, Swz.
Common Southward..

1755. **Pellea** atropurpurea, Link.
Common.

1756. gracilis, Hook.
Boone, (Galloway), Newton, (Broadhead).

1757. **Woodwardia** Virginica, Smith.
Common.

1758. **Asplenium** angustifolium, Michx.
Common.

1759. ebeneum, Ait.
Common.

1760. ebenoides, Scott.
Franklin, Iron, Jefferson and St. Louis, (Letterman)

1761. Filix fœmina, Bernh.
Miller, (Winick), St. Louis, (Letterman).

1762. parvulum, M. & G.
Christian, (Shepard), Greene and Jackson, (Bush).

1763. pinnatifidum, Nutt.
Greene, (Shepard).

1764. thelypteroides, Mich.
Common.

1765. trichomanes, L.
Miller, (Winick), St. Louis, (Letterman).

1766. **Camptosorus** rhizophyllus, Link.
Common everywhere.

1767. **Phegopteris** hexagonoptera, Fee.
Common from Boone Eastward.

1768. **Aspidium** acrostichoides, Swz.
Common.

1769. Lonchitis, Swz.
Madison, (Broadhead), Miller, (Winick).

1770. marginale, Swz.
St. Louis, near Allenton, (Letterman).

1771. spinulosum, Swz.
Butler and St. Louis, (Letterman).

1772. Thelypteris, Swz.
Butler and St. Louis, (Letterman).

1773. **Cystopteris** bulbifera, Bernh.
Common.

1774. fragilis, Bernh.
Common.

1775. **Onoclea** sensibilis, L.
Jackson, (Bush), St. Louis, (Letterman), Scotland, (Broadhead).

1776. **Woodsia** obtusa, Torr.
Jackson, (Bush), St. Louis, (Geyer).

1777. **Dicksonia** pilosiuscula, Willd.
Scotland, (Broadhead).

1778. **Osmunda** cinnamonea, L.
Franklin, (Letterman).

1779. Claytoniana, L.
Pike, (Pech).

1780. regalis, L.
Butler and St. Louis, (Letterman).

SALVINIACEÆ.

1781. **Azolla** Caroliniana, Willd.
Howell, (Swallow), Jackson, (Bush).

LYCOPODIACEÆ.

Club-Moss Eamily.

1782. **Lycopodium** dendroideum, Michx.
Madison, (Broadhead).

SELAGINELLACEÆ.

1783. **Selaginella** rupestris, Spring.
Adair, (Broadhead), Jefferson and St. Louis, (Letterman).

ISOETACEÆ.

1784. **Isœtes** echinospora, Durien, var. Braunii, Engelm.
Jackson, (Bush).

1785. Engelmanni, Braun.
"Missouri," (Gray's Manual, 5th Ed.)

ABSTRACT OF ASSESSMENT returns from the several counties of the State of Missouri for the year 1885, showing the number of horses, mules, asses, jennets, neat cattle, sheep and hogs.

COUNTIES.	LIVE STOCK.							
	HORSES.		MULES.		ASSES AND JENNETS.		NEAT CATTLE.	
	Number.	Valuation.	Number.	Valuation.	Number.	Valuation.	Number.	Valuation.
Adair	7,305	$240,765	727	$26,010	18	$675	21,579	$331,335
Andrew	7,994	326,620	1,836	80,775	73	3,875	26,072	309,930
Atchison	8,083	344,474	2,502	129,017	36	1,510	24,474	425,908
Audrain	8,467	319,795	3,761	153,480	102	5,555	27,640	344,085
Barry	5,843	197,290	1,817	80,492	60	2,169	17,442	171,250
Barton	8,234	215,047	1,984	64,194	36	1,690	35,974	257,327
Bates	13,544	441,506	3,211	128,454	71	4,160	32,879	418,558
Benton	6,742	240,835	1,706	72,315	62	2,435	24,561	313,320
Bollinger	3,750	161,810	1,338	65,115	24	1,460	11,085	93,985
Boone	8,305	291,405	3,508	144,675	123	6,745	18,383	279,935
Buchanan	8,141	334,195	2,884	155,310	....	....	18,756	228,400
Butler	1,336	41,970	483	20,520	7	140	6,384	54,954
Caldwell	9,207	351,282	1,329	53,435	31	3,610	28,415	424,637
Callaway	8,346	327,370	3,130	185,550	156	13,490	21,620	355,440

ABSTRACT OF ASSESSMENT—CONTINUED.

COUNTIES.	LIVE STOCK.							
	HORSES.		MULES.		ASSES AND JENNETS.		NEAT CATTLE.	
	Number.	Valuation.	Number.	Valuation.	Number.	Valuation.	Number.	Valuation.
Camden	3,123	$97,559	876	$38,915	29	$575	12,927	$135,191
Cape Girardeau	5,560	206,240	2,588	101,890	54	3,565	13,499	118,495
Carroll	11,205	396,621	3,803	183,932	....	....	32,522	401,019
Carter	680	31,707	227	15,550	7	265	2,744	28,848
Cass	12,253	455,736	2,862	138,194	....	....	26,396	353,886
Cedar	6,780	214,931	1,651	63,064	60	3,085	20,628	247,377
Chariton	9,892	321,242	3,116	113,195	45	2,230	29,922	365,983
Christian	4,281	168,116	1,222	55,487	28	1,355	11,025	115,705
Clark	7,625	245,085	700	27,240	31	1,070	19,616	226,965
Clay	6.831	246,369	1,709	81,505	75	5,220	23,131	446,887
Clinton	7,794	215,225	2,066	76,820	37	2,390	28,602	389,035
Cole	3,291	113,749	1,379	53,455	15	560	7,939	77,968
Cooper	7,098	277,715	3,961	216,949	87	4,160	17,863	298,963
Crawford	3,127	109,656	1,530	68,309	61	2,005	11,868	99,439

Dade	7,194	230,841	1,787	69,231	28	1,560	23,936	243,353
Dallas	4,644	162,867	1,386	48,901	47	1,347	14,298	128,367
Daviess	11,248	412,880	1,460	59,938	56	3,735	33,779	502,441
DeKalb	8,282	289,905	961	40,395	27	1,665	20,172	275,956
Dent	2,819	109,999	1,132	47,145	39	946	10,952	118,444
Douglas	2,672	123,063	651	30,186	28	845	7,575	79,326
Dunklin	2,262	100,785	1,233	63,439	18	837	10,351	88,626
Franklin	5,681	196,885	3,824	150,170	26	760	17,741	185,908
Gasconade	2,703	102,574	2,187	92,983	18	515	9,811	94,442
Gentry	9,567	347,775	1,006	37,645	44	2,865	28,454	401,620
Greene	9,671	415,317	2,923	153,055	61	5,700	19,939	259,492
Grundy	6,493	262,957	901	35,111	39	1,845	22,706	346,717
Harrison	12,283	435,648	1,331	49,393	51	3,085	39,158	515,221
Henry	10,992	418,571	3,135	147,255	94	4,643	27,988	416,906
Hickory	4,816	188,108	1,050	45,495	32	2,128	19,002	225,559
Holt	6,098	270,050	2,231	119,165	22	1,040	18,406	274,970
Howard	4,878	186,835	2,713	134,315	31	2,970	15,981	259 887
Howell	3,044	104,658	1,431	48,718	32	755	12,718	109,842
Iron	1,417	58,880	903	46,595	14	550	5,571	58,615
Jackson	13,149	517,510					26,177	357,703
Jasper	10,867	390,358	2,400	126,824	30	1,750	27,888	343,357

ABSTRACT OF ASSESSMENT—CONTINUED.

COUNTIES.	LIVE STOCK.							
	HORSES.		MULES.		ASSES AND JENNETS.		NEAT CATTLE	
	Number.	Valuation.	Number.	Valuation.	Number.	Valuation.	Number.	Valuation.
Jefferson	4,146	$136,396	2,469	$90,753	40	$778	13,224	$129,544
Johnson	10,749	440,185	4,331	224,455	56	3,735	24,711	323,605
Knox	7,274	281,337	1,173	41,413	18	1,306	22,695	359,542
Laclede	4,802	169,930	1,207	44,280	45	1,675	16,856	157,025
Lafayette	11,668	396,465	5,400	217,175	55	3,400	30,206	400,415
Lawrence	7,596	341,869	2,540	121,980	41	3,161	21,145	229,007
Lewis	8,678	268,085	1,898	65,790	35	3,660	21,960	301,840
Lincoln	6,614	245,970	1,485	60,835	15	1,245	17,108	216,310
Linn	8,805	307,964	1,266	50,199	27	2,105	29,738	540,937
Livingston	8,715	315,207	1,374	53,708	33	2,195	28,748	378,654
McDonald	3,430	139,790	895	43,117	25	1,241	9,438	94,154
Macon	11,906	445,368	3,011	125,514	118	5,345	36,487	496,226
Madison	2,081	75,451	733	30,550	24	1,985	5,726	59,412
Maries	2,837	91,005	1,643	73,705	27	890	12,798	123,076

Marion	7,222	289,635	1,301	58,835	25	1,760	16,237	275,894
Mercer	7,085	240,211	462	16,375	20	720	26,864	332,778
Miller	3,930	148,285	1,354	56,356	26	920	9,304	114,431
Mississippi	1,261	50,270	1,846	84,985	14	445	5,650	43,659
Moniteau	5,953	198,870	2,404	83,140	46	1,855	17,822	159,325
Monroe	8,837	307,270	3,580	122,185	110	5,495	24,100	362,365
Montgomery	5,803	207,832	1,976	86,715	56	2,660	14,630	178,144
Morgan	4,482	160,384	1,818	80,856	54	2,867	14,039	166,915
New Madrid	1,333	51,410	1,388	64,530	16	515	5,725	46,083
Newton	6,990	243,136	1,494	69,173	35	1,180	17,089	195,222
Nodaway	17,386	629,206	2,575	105,181	62	3,930	50,806	606,805
Oregon	1,895	72,911	745	33,336	12	400	7,730	68,924
Osage	2,488	94,695	2,926	130,560	27	1,100	11,306	116,307
Ozark	2,041	77,680	582	26,038	15	865	7,522	75,275
Pemiscot	1,041	42,697	515	27,890	7	255	4,828	35,368
Perry	3,951	142,600	1,943	83,091	14	615	9,291	82,591
Pettis	9,883	328,581	3,489	140,169	65	3,780	27,777	441,392
Phelps	3,286	99,396	1,070	37,223	37	1,373	10,437	104,675
Pike	7,927	357,980	2,473	138,135	54	4,670	21,767	356,940
Platte	5,757	228,790	2,049	103,425	34	2,495	14,852	240,675
Polk	7,151	272,969	2,481	104,160	66	3,235	21,869	231,383

ABSTRACT OF ASSESSMENT—CONTINUED.

COUNTIES.	LIVE STOCK.							
	HORSES.		MULES.		ASSES AND JENNETS.		NEAT CATTLE.	
	Number.	Valuation.	Number.	Valuation.	Number.	Valuation.	Number.	Valuation.
Pulaski	2,738	98,200	762	$33,545	23	$465	10,553	$118,290
Putnam	7,174	243,784	944	37,505	35	1,395	28,386	352,623
Ralls	6,217	264.050	1,888	99,550	61	3,315	17,553	282,525
Randolph	6,302	252,655	2,245	92,125	31	2,580	11,055	184,575
Ray	9,037	386,565	3,568	168,685	70	4,520	28,751	456.163
Reynolds	1,552	80.545	944	61,215	15	500	6,602	79,553
Ripley	1,636	55,631	759	31,942	11	180	8,470	79,088
St. Charles	5,486	226,445	3,496	169,385	16	575	10,605	159,225
St. Clair	8,824	328,550	1,821	78,780	59	2,745	30,814	386,895
St. Francois	2,498	84,800	1,057	37,090	25	945	7,913	68,510
St. Genevieve	2,614	88,919	993	34,329	13	525	6,394	65.474
St. Louis	6,632	307,615	4,043	212,775	....	....	9,854	186,396
St. Louis City	17,087	987,009	3,609	188,480	....	....	9,170	182,768
Saline	11,080	421,130	5,905	290,210	109	6,460	28,493	455,613
Schuyler	5,021	197,252	403	14,736	21	1,005	16,193	187,681

Scotland	7,731	276,920	874	35,940	38	2,165	21,971	272,460
Scott	2,140	82,528	1,721	83,290	15	835	8,021	63,366
Shannon	1,193	38,960	276	10,570	8	205	3,726	31,603
Shelby	8,274	325,005	1,945	75,850	66	5,475	24,074	387,987
Stoddard	3,274	112,153	1,511	58,440	40	1.197	12,515	81,508
Stone	1,961	73,693	529	24,309	26	1,050	7,042	63,279
Sullivan	8,665	342,215	1,348	60,315	41	2,108	37,561	591,105
Taney	2,926	90,134	515	23,877	21	679	9,584	122,370
Texas	4,129	158,185	1,598	50,385	54	2,660	12,343	139,727
Vernon	11,239	350,057	2,910	111,540	64	3,345	33,833	487,485
Warren	2,968	102,000	1,724	71,130	21	870	10,326	100,720
Washington	2,409	77,255	1,345	49,300	29	850	9,136	82,140
Wayne	2,455	97,115	1,089	53,009	38	1,585	7,550	75,855
Webster	4,899	198,747	1.943	84,653	56	2,630	12,320	125,510
Worth	4,813	185,196	449	15,003	50	2,415	12,799	172,903
Wright	4,591	187,153	1,314	58,849	46	2,320	11,663	119,141
Totals	718,185	$26,881,076	214,075	$9,492,450	4,521	$242,990	2,081,764	$26,815,263

ABSTRACT OF ASSESSMENT.—Continued.

Counties.	Sheep.		Hogs.		And all other live stock.	
	Number.	Valuation.	Number.	Valuation.	Number.	Valuation.
Adair	12,548	$12,640	23,228	$41,005		$140
Andrew	5,449	3,775	65,589	112,685		
Atchison	2,640	2,634	48,249	123,209		3,915
Audrain	11,008	12,920	22,271	32,370		
Barry	11,399	10,206	28,026	28,291		
Barton	5,269	5,110	23,301	29,396	13	173
Bates	9,896	7,338	44,983	101,153	24	1,100
Benton	10,451	10,675	27,290	45,910		
Bollinger	11,405	11,880	18,868	29,870	3	10
Boone	9,966	18,950	26,453	55,885		
Buchanan	3,514	3,940	37,352	73.960		
Butler	991	1,063	11,876	13,809		
Caldwell	24,587	17,139	37,919	69,019		
Callaway	33,220	34,760	30,664	58,450		
Camden	5,838	5,833	18,842	20.693		
Cape Girardeau	16,533	17,135	32,821	36,115		165

Carroll	8,414	7,685	45,433	74,168		
Carter	1,052	1,049	4,658	6,154		
Cass	5,331	5,333	55,624	96,341		
Cedar	13,017	13,086	28,395	30,779	1,576	1,601
Chariton	9,000	9,317	37,876	52,506	4	530
Christian	9,914	8,641	24,283	25,338		
Clark	13,025	13,025	15,650	28,325		
Clay	9,651	12,197	29,774	65,323		990
Clinton	11,517	12,000	48,790	71,405		
Cole	8,162	8,121	14,945	21,883		66
Cooper	23,802	25.549	33,885	56,230		
Crawford	6,468	4,273	19,584	21,133		
Dade	13,270	9,088	30,970	29.937		932
Dallas	13,915	10,726	14,983	24,179		
Daviess	19,810	17,159	44,295	77,136		4,994
DeKalb	5,288	3,961	31,317	65,999	1,465	
Dent	7,213	7,299	18,627	19,079		
Douglas	6,479	8,201	20,332	20,458		
Dunklin	1,707	1,668	21,653	30,198		50
Franklin	9,101	10,290	29,470	47,465		95
Gasconade	7,578	8,839	14,746	16,049		

ABSTRACT OF ASSESSMENT.—CONTINUED.

COUNTIES.	SHEEP.		HOGS.		AND ALL OTHER LIVE STOCK.	
	Number.	Valuation.	Number.	Valuation.	Number.	Valuation.
Gentry	14,503	$13,430	40,510	$74,480	....	....
Greene	19,631	14,162	42,811	62,953	5	$7
Grundy	25,487	24,913	17,624	29,951	65	510
Harrison	25,862	21,494	41,369	75,074	....	....
Henry	6,433	7,544	39,468	90,169	....	....
Hickory	10,658	10,638	19.226	28,934	1	1
Holt	1,596	1,595	42,741	93,400	....	....
Howard	11,917	12,393	19,872	40,220	....	15
Howell	5,613	5,557	24,052	22,091	24	23
Iron	2,659	2,740	5,647	7,525	....	....
Jackson	12,657	13,619	39,257	65,637	....	....
Jasper	9,148	9,063	34,242	47,377	....	2,181
Jefferson	7,480	7,570	19,735	24,719	27	357
Johnson	6,689	5,930	35,108	66,710	20	100
Knox	13,105	11,838	28,072	41,320	....	....
Laclede	8,284	8,340	18,888	20,620	16	15

Lafayette	9,531	10,780	34,676	102,205	....	....
Lawrence	15,625	13,500	33,488	44,129	1,990	2,560
Lewis	12,147	12,105	21,178	31,857	....	....
Lincoln	12,264	13,520	27,829	52,305	....	....
Linn	15,524	11,325	24,996	43,669	....	1,100
Livingston	17,540	16,504	31,102	54,793	457	4,304
McDonald	8,248	8,304	22,820	26,056	....	....
Macon	18,027	18,034	38,460	51,467	....	3,169
Madison	4,392	4,520	8,594	11,986	....	13
Maries	7,269	7,269	18,417	18,417	....	....
Marion	10,643	14,650	18,437	40,699	1	2
Mercer	17,116	14,913	25,726	46,016	....	898
Miller,	12,380	12,482	25,960	31,197	....	....
Mississippi	411	454	9,907	14,764	....	....
Moniteau	13,318	13,295	28,675	49,600	....	....
Monroe	17,917	18,035	26,186	47,370	....	....
Montgomery	12,335	11,872	19,653	42,386	56	561
Morgan	11,702	11,984	19,967	32,007	....	....
New Madrid	664	901	10,199	17,640	13	15
Newton	9,272	9,190	28,998	36,367	....	....
Nodaway	6,254	4,760	107,216	172,752	....	18

ABSTRACT OF ASSESSMENT—CONTINUED.

COUNTIES.	SHEEP.		HOGS.		AND ALL OTHER LIVE STOCK.	
	Number.	Valuation.	Number.	Valuation.	Number.	Valuation.
Oregon	3,238	$3,238	17,747	$18,358	2	$2
Osage	9,565	9,653	19,950	30,940		3,466
Ozark	3,607	3,598	12,986	13,581		
Pemiscot	252	280	8,884	16,252		3,223
Perry	10,158	9,568	19,496	27,267		5,964
Pettis	19,912	19,775	28,248	53,123		
Phelps	8,321	8,287	16,925	17,884	10	10
Pike	18,145	22,750	25,060	50,465		
Platte	2,773	2,845	30,623	74,715		
Polk	21,632	14,274	29,425	35,704	2	248
Pulaski	5,125	5,125	17,165	22,055		
Putnam	16,253	15,690	21,637	29,912	34	691
Ralls	9,432	13,225	18,310	46,095		
Kandolph	13,623	15,017	13,351	24,772	6,733	134,030
Ray	10,066	10,729	34,778	76,514	3	15
Reynolds	3,826	3,871	11,579	14,874		

Ripley	2,795	2,796	12,332	12,401		
St. Charles	5,185	6,455	22,948	48,925		
St. Clair	11,804	10,652	35,856	49,365		42
St. Francois	4,081	3.850	6,734	7,675		
Ste. Genevieve	3,378	3,378	9,879	12,132		
St. Louis	4,750	7,015	20,676	62,300		
St. Louis city	229	1,075	1,876	8,070		921
Saline	9,886	10,159	36,635	83,565		
Schuyler	24,309	19,213	17,347	28,284		3,933
Scotland	15,360	11,655	22,558	44,105	2	5
Scott	1.236	1,229	17,235	20,072	23	21
Shannon	2,070	2,070	6,790	6,860		
Shelby	18,569	16,125	22,748	42,209		
Stoddard	4,248	4,156	26,026	26,041	3	22
Stone	5,333	2,999	11,455	11,687		
Sullivan	16,534	15,430	18,047	30,321		2,589
Taney	3,270	3,223	13,065	15,067		
Texas	9,628	10,947	22,220	25,560	21	110
Vernon	6,011	4,447	32,716	49,349	174	1,023
Warren	6,751	6,765	17,477	30,680		4,430
Washington	5,005	5,229	12,737	13,914		

ABSTRACT OF ASSESSMENT.—CONTINUED.

COUNTIES.	SHEEP.		HOGS.		AND ALL OTHER LIVE STOCK.	
	Number.	Valuation.	Number.	Valuation.	Number.	Valuation.
Wayne	4,057	$4,060	16,389	$25,342		$32
Webster	16,715	16,719	23,481	28,369	100	100
Worth	3,953	3,327	21.687	34,606		10
Wright	15,075	15,099	23,467	23,994	22	16
Totals	1,148,555	$1,108,766	2,931,671	$4,804,151	12,889	$175,473

INDEX.

A

PAGE

Alfalfa 88, 370
Animals—Responsibility of owners of 352, 355
Annual meeting of the Board, 1884 26
Annual meeting of the Board, 1885 35
Ashes—Analysis of 53
    Use of as a fertilizer 54

B

Barley 116
Bean--Soja 371
Bermuda grass 109
Black-leg 217, 271
Bloat 223
Blue-grass--Kentucky 79
Board of Agriculture—Farmers' Institute Meetings of 33, 265
    Work of, for 1885 24
Bots in horses 288
Bottle grass 99
Breeding—Stock 280, 331
Bronchitis—Parasitic 219
Broom grass 101
Burr grass 99
Buying and selling—Law of 341, 360

C

Canary seed grass 103
Cane -Small 118
Carboniferous—The Lower 252
    The Upper 251

PAGE

Catarrhal troubles in horses 213
Cheat 115
Cheat—Wild 116
Cholera—Hog 215
Clover—Alsike 88
  Bush 89
  Red 86, 371
  White 88
Coal-fields of Missouri 251
Cord grass 99
Corn—Egyptian 372
Couch grass 116
Crab grass 97
Crops—Rotation of 269, 296, 322
Crops of 1885—Comparative results of 200
  Observations on 3
  Review of reports on 196
  Statistics of, for State 203

D

Dairy—The home 334
Digestive apparatus of cattle 221
Dower—Law of 362
Drainage—Cost of 367, 393
  Theory of 394
Drainage of Bonnie Blue Farm 391
Drainage rights—Laws relating to 359
Draining for stock water 366
Drop seed grass 106

E

Epidemics of the year—Observations on 5
  Report on 210
Ergotism 226

F

Farmers' Meeting at Butler 316
  at Chamois 321
  at De Soto 299
  at Fulton 322
  at Lewiston 294
  at Marshall 265
  at Mexico 33
  at Palmyra 287
  at Verona 315

PAGE

Farm boundaries—Law of
Farming—Improved methods in, demanded 306
    Our, condition and outlook 300
Farm law of Missouri—The 340
Fat-Stock Show—The Kansas City 284
Fatty infiltration 232
Fences—Law of 350
Fertilization—Remarks on 41
Fertilizers—Indirect 44
Fescue—Meadow 84
    Sheep's 84
Fires—Responsibility as to 356
Fly catch grass 101
Flora of Missouri 397
Forestry—Laws relating to 365
    Observations on 263
Foxtail—Bristly 98
    Green 99
    Meadow 77
Founder in animals 271
Fruits 262, 289, 297, 299, 316
Fruits—Small 261
Fungi—Parasitic 278

G

Gardening—Market 261
Gentry, R. W.—Resolutions on death of 29
Geological sketch of Missouri 250
Glanders 214
Glossary of botanical terms 119
Granite—Missouri 259
Grasses—Botanical description of 71
    Calculation of food value of 73
    Classification of 96
    Comparison of, at various stages of growth 94
    Composition of 72
    Illustrations of 96-118
    Index of, (botanical names) 122
Grass lands—Improvement of 90

H

Hair Grass 108
Hannibal—Recent progress of 207
Horse—The 279
Hydrophobia—Some instances of 230

J

PAGE

- Job's tears 99
- Johnson grass 102, 370

K

- Kansas City—Recent progress of 204

L

- Lampass or lampers 319
- Landlord and tenant—Laws relating to 344
- Lands—Agricultural College 174
  - Companies owning, in Missouri 177
- Lands—Government—Homestead entry of 181
  - In Missouri .... 171—173
  - Pre-emption of 180
  - Private entry of 179
  - Soldiers homestead entry of 184
  - Tree claim entry of 185
- Lands—Railroad, in Missouri 176
- Legislation—Proposed changes in, as affecting Board of Agriculture 28
- Lead ores of Missouri 253
- Limestone—Lithographic, of Missouri 254
- Limestones—The Magnesian 255

M

- Maize—Milo 372
- Manure—Analysis of 60
  - Application of 65
  - Chemical 55
  - Composition of 57
  - Fermented 68
  - Liquid 63
  - Preservation of 60
  - Value of certain foods as producers of 59
- Master and servant—Laws relating to 346, 358
- Meadow grass—Fowl 82
- Millet grass 105
- Milk fever in cows 227
- Murrain—Dry 224
  - Bloody 271
- Muskit grass 110

N

PAGE

Nimble-will 105

O

Oat grass—Black 104
    Wild 108
Orchard grass 76
Orcharding 262, 289, 297, 299, 316

P

Pasteur, Louis—Researches of 216
Pastures—Seed mixtures for 91
Plaster—Composition of 51
    Use of, as a fertilizer 52
Pleuro-pneumonia--Convention at Mexico to consider 13
    Dr. Michener's report on 14
    Dr. Trumbower's report on 8
    First appearance of, in Missouri 5
    Historical sketch of 18
    State Veterinarian's report on 18
    Symptoms of 19
    Treatment of 20
Porcupine grass 104
Plowing—Hints on 274, 292
Plows—Historical sketch of 273
Poll-evil 319
Prickley comfrey 371

R

Railroads—Earnings and expenses of 188
    Narrow gauge 187
Railroads opened in 1884 186
Rattle snake grass 114
Red top 78
Red top—Tall 111
Renting—Laws relating to 344
Reed gras —Giant 111
    Tall 115
Rice—False 101
    Indian 100
    Mountain 104
Right of way—Laws relating to 347

PAGE

- Roads—Construction of 244
  - Drainage of 244
  - Essential qualities of 236
  - Grades on 239
  - Laws relating to public 349
  - Location of 242
  - Maintenance of 247
- Rye grass 85
- Rye grass—Wild 117

S

- Sainfoin 371
- Salt—Use of as a fertilizer 52
- School funds—Amounts of, for 1885 190
  - How increased 191
- Schools—Statistics of, by counties 192
- Sesame grass 100
- Shares—Letting land on the 345
- Sheep husbandry—Observations on 4
- Soil—Analysis of 43
  - Plant analysis of 46
- Soils—The origin of .... 380—390
- Sorghum 102
- Spear grass—Low 83
- Speculation—Evils of 312
- Statistics—County 159
  - Crop 203
  - Educational 190
  - Land 171
  - Railroad 186
- Stock—The farmers' interest in improvement of 327
  - Assessment of for 1885 .... 501—514
- Stock feeding 325
- Subsoiling 374

T

- Testamentary devise—Law of 363
- Texas fever 272
- Tick seed 89
- Timothy 78
- Trespasses—Laws relating to 354

V

- Vernal grass—Sweet 86
- Vetch 371
- Veterinarian—Report of State 210
- Vineyards 261

W

PAGE

Water power, etc., etc., of counties.... 160
Water rights—Law of.... 359
Wheat grass—Awned.... 116
White grass.... 101
Wire grass.... 82
Wood reed grass.... 107
Woolly beard grass.... 101

Z

Zinc ores of Missouri.... 253

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